HEALTH INQUIRY

(POLIOMYELITIS)

HEARINGS

BEFORE THE

COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE HOUSE OF REPRESENTATIVES

EIGHTY-THIRD CONGRESS

FIRST SESSION

ON

THE CAUSES, CONTROL, AND REMEDIES OF THE PRINCIPAL DISEASES OF MANKIND

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HEALTH INQUIRY
(Poliomyelitis)

TUESDAY, OCTOBER 6, 1953

HOUSE OF REPRESENTATIVES,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
Washington, D. C.

The committee met, pursuant to adjournment, at 10 a. m. in the committee room of the House Committee on Interstate and Foreign Commerce, the Honorable Charles A. Wolverton (chairman) presiding.

The CHAIRMAN. The committee will come to order. The schedule for these hearings seeking to bring before the American people certain important facts about health and disease called for this day, Tuesday, October 6, to be devoted to a discussion of the broad field of poliomyelitis, its importance as a disease, its cost in both human and economic terms, its unresolved medical problems, and its promising research areas.

The National Foundation for Infantile Paralysis—a voluntary health agency in this field—is unable to be present here today because of prior involvement in a meeting now being held in West Virginia. The appearance of its representatives will be deferred until Monday, October 12, at which time we will expect also to hear authorities from the United States Public Health Service and other interested and informed scientists and laymen.

The two aspects of polio prevention and treatment to be delved into today are suitable for separate hearings. This morning we will hear testimony from several witnesses on behalf of the Sister Kenny Foundation. This afternoon, beginning at 1:30 p. m., if the Sister Kenny witnesses have finished by that time, we will seek to get current information on the use of gamma globulin in connection with the prevention of poliomyelitis.

We regret that Dr. Edwin J. Cohn, whose chemical research gave the world the polio combatant gamma globulin, died of a cerebral hemorrhage on Friday night last.

A world leader in the basic research in the physical chemistry of proteins, Dr. Cohn's work made possible the fractionation of blood plasma during World War II.

It provided serum albumin for the treatment of shock, glamma globulin for measles and polio, thrombin and fibrinogen which produce clotting for surgery, and other medically important blood fractions.

His work resulted in the saving of thousands of lives by effective treatment of battlefield and accident shock and the alleviation of pernicious anemia through liver extract.

Dr. Cohn was director of the Harvard Laboratory of Physical Chemistry, related to medicine and public health. He conducted all of his experiments at Harvard since 1920.

He was a native of New York. He attended Amherst College and the University of Chicago and did graduate work at Chicago, Harvard, Yale, and Cambridge University, England.

I again express our regret at his passing, particularly at this time.

We will now turn to the testimony of those who will testify in connection with the Sister Kenny Foundation. In that connection I may say that at a hearing previously held by this committee some years ago we had the privilege of having the personal presence and testimony of Sister Kenny. She made an indelible impression on all who were present on that occasion, both as to her sincerity and her conviction and her ability. We regret that she, likewise, has passed on into the great beyond and that her services, except as they are carried on by those who are familiar with them, have been lost to us. She was a great character and one who deserves all the honors that have been paid to her.

May I inquire as to who will be the discussion leader of this group this morning?

(A list of participants follows:)

PARTICIPANTS

Mr. Marvin L. Kline, executive director, Sister Elizabeth Kenny Foundation
Dr. Gaylord Anderson, director, School of Public Health, University of Minnesota; former president, American Public Health Association
Dr. Claus Jungeblut, professor of bacteriology, Columbia University
Dr. Paul Elwood, director, inpatient service, Sister Elizabeth Kenny Foundation

Mr. KLINE. I will, sir.

The CHAIRMAN. What is the name, please?

Mr. KLINE. Marvin Kline.

The CHAIRMAN. Mr. Marvin Kline, executive director of the Sister Elizabeth Kenny Foundation.

Mr. KLINE. Right.

The CHAIRMAN. Mr. Kline, if you will, please introduce the other members of the panel who will participate today, giving such background as you may wish in connection with their introduction, after which you may proceed in your own way to develop the story of the Sister Kenny Foundation and what it has accomplished. It is well known that the work of Sister Kenny has caused a reevaluation of the techniques of treatment for poliomyelitis. There has been a great deal of good results from what is known as the Sister Kenny method, and there has never been a question concerning the dedication to the relief of human suffering which has characterized the Kenny workers through the years.

This committee is pleased to have your testimony here today. Will you now proceed, Mr. Kline.

STATEMENT OF MARVIN L. KLINE, EXECUTIVE DIRECTOR, SISTER ELIZABETH KENNY FOUNDATION

Mr. KLINE. Thank you, Mr. Chairman and members of the committee. First I would like to introduce Dr. Claus Jungeblut, professor of bacteriology at Columbia University, on the extreme left.

May I present also Dr. Gaylord Anderson, director of the School of Public Health of the University of Minnesota, who is also chairman of the medical advisory committee on polio in the State of Minnesota.

Dr. Paul Elwood, in charge of inpatient care at the Kenny Institute at Minneapolis.

Mr. Fred Fadell, my associate in the Kenny work, and director of the information service.

We are very pleased to have the opportunity to be here today to participate in this series of hearings you are having on public health. I think probably in getting our story told that I should give a brief résumé of the highlights of the establishment of the Kenny work and the Sister Kenny Foundation, leading into our policies and program.

As the chairman mentioned, Sister Kenny appeared before this committee several years ago, at which time I had the privilege of attending. You got quite well acquainted with this great lady.

My first experience in meetings with Sister was, personally, when I was a member of the City Council of the City of Minneapolis, and she appeared before a board of public welfare in 1940. She came in with a couple of doctors who had observed her work for a few weeks. They thought that maybe she had something.

We in government at that time thought: "Well, if what she has to tell us is worth one-hundredth of what she claims it is, at least it is worth checking further."

From a small beginning in that way Minneapolis got interested in the Kenny program. For several years—in fact, about 3½ years—the city of Minneapolis sponsored Sister's work in the care of polio cases, helping her and others interested in her work, to make it available to any who wanted to participate in medical seminars or in her treatment program.

Finally this got beyond the scope of a local municipal government. Through a series of events, a number of citizens there and elsewhere decided to carry on this work, and see that there were more doctors informed about her work, which had been proved and approved by a number of leading doctors in our area, to train nurses and physical therapists to do the actual treatment. An organization was then formed that is now the Sister Kenny Foundation. Back in 1943 the Kenny Foundation was formed. In 1944 the first public subscription campaign was put on.

Then, as now, most of that money came from the Minnesota area, although through the last few years it has spread more and more into other areas, and we have found that the public has been very generous.

The policy of the Kenny Foundation is quite to the point. We were set up originally, from the experience with Sister and the medical approval of her treatment, to make sure that we could train the personnel and carry out the treatment that she brought to us. That is still one of the main parts of our program. In doing this we found that it was necessary to take over facilities and, in Minneapolis, to build a hospital.

We have there at the present time a hospital strictly for polio that will house 250 patients. In overcrowded periods we have had as high as 300 in that facility.

I know at times in the past there was a lot of feeling on the part of many that polio was a seasonal disease and it was not necessary to build hospitals especially to take care of polio. It is not the policy

of the Kenny Foundation necessarily to build hospitals. Our preference would be to get space in an existing hospital that has a medical staff; but in many of the hospitals throughout the country they are overcrowded with other diseases and other problems, and it is not always easy to get into an existing hospital.

Our point is that if we have to build we are willing to build, so that we can take care of patients from the onset of the disease until maximum recovery has been attained. Unfortunately there still exists in many hospitals throughout the country a situation where the patients, probably out of necessity because of lack of hospital beds, are sent home, in our estimation, prematurely.

Another important part of our program is the medical seminars that we conduct. We have medical seminars from time to time. We have doctors not only from the United States but from all over the world who come in for these seminars.

Furthermore, we have medical men visiting the institute, you might say practically at all times, from the United States and from foreign countries. We take graduate nurses, registered nurses, and physical therapists who qualify under our scholarship program, and we give them a 2-year specialized course in poliomyelitis under the Kenny technique.

We have found that this highly skilled, trained personnel is able to carry out the Kenny technique and give the patient the best care that can be given in polio. Of course, this is all done under the supervision of medical men. That is why we conduct medical seminars and, shall I say, train medical people. We do not feel as an organization that we care to go into any hospital unless, first, there are medical men there who want us in; that some doctors there have had an opportunity to study the Kenny method; that they believe in the Kenny method; and that they will work then with these highly skilled Kenny therapists we have trained. We have found that the results are very good.

We are also pleased to report that in the brief years of our experience and growth we have been accepted medically more and more, which is the important thing.

Through this period of growth we have attempted to maintain the highest of medical standards and treatment. Basically that is what we are set up for.

Now, over and above that, we have some research. The Kenny Foundation is not attempting to raise a great lot of funds for research. It is, you might say, a small part of the Kenny Foundation program. We do spend money—small, compared to the National Foundation, of course—for clinical research. We have a research program at Columbia University under the direction of Dr. Jungeblut.

But over and above that our program, as outlined, is to train personnel, to inform medical men of the Kenny treatment, and to take care of patients.

I think we do not have any set program to present to you gentlement this morning other than having these very qualified doctors in attendance here who can express their viewpoints on various medical aspects. We also will, of course, welcome any questions.

To start off the discussion from our witnesses I might ask Dr. Gaylord Anderson, who is not directly connected with the Kenny Foundation, to express his viewpoint as to the medical program and

the medical personnel, as well as the type of medical personnel that we have running the Kenny Foundation and the Kenny Institute which is located in Minneapolis.

When I refer to that, of course, as many of you know, we do have other Kenny Institutes, but the one in Minneapolis is the international training center for doctors and nurses and physical therapists.

At this time I would like to ask Dr. Anderson if he would care to express his viewpoints on our medical setup at the Kenny Institute and the Kenny Foundation.

STATEMENT OF DR. GAYLORD ANDERSON, DIRECTOR, SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF MINNESOTA; FORMER PRESIDENT, AMERICAN PUBLIC HEALTH ASSOCIATION

Dr. ANDERSON. Mr. Chairman, I greatly appreciate this opportunity of appearing before your committee. In order to keep the record straight, as Mr. Kline has said, I have no official connection with the Kenny Institute. I notice here on this paper that I am listed as president of the American Public Health Association. I think, for the sake of the present president, we had better say former president. The association does not believe in more than one term of office.

I also appear as chairman of the Minnesota State Advisory Commission on Poliomyelitis, an agency set up by the State health department to deal with the overall problem of polio in the community.

The CHAIRMAN. That is a commission of the State of Minnesota?

Dr. ANDERSON. A commission set up by the Minnesota State health department. It is an advisory commission to deal with problems which confront that department, and to deal with problems dealing with hospitalization and the total problem of meeting polio outbreaks when they appear in the State.

Now, Mr. Kline has referred to the quality of the medical care at the Kenny Foundation. I would like to say a word or two more about that.

Whenever any new method of treatment appears, there is always a feeling on the part of some persons in the community that this is a bit irregular and perhaps does not quite fit into the usual standards of medical care, the high standards of the medical profession. I think it is fair to say, and we all recognize, that for many years people looked upon the Kenny method as falling in that category. The late sister was rejected by many medical groups.

When she came to Minnesota she found a very cordial reception not simply by the group to which Mr. Kline has properly referred, but also by the medical faculty of the University of Minnesota. The faculty was concerned with finding out everything it could about improved methods of treatment. As a faculty we neither endorsed nor disapproved of any one treatment, officially, but we did recognize that here was something to study, and the sister was given a most welcome reception and given an opportunity to show what she had in her ideas as to treatment.

I think I can say that from very early in her experience in Minneapolis, those of us on the staff of the medical school, both those of us in the basic sciences and those in the clinical fields very quickly became convinced that here was a method of treatment that had some-

thing, that had very real value. It offered something that we were not getting from our other methods.

I had the privilege of being one of the early members of the staff to go down and see some of this. We have, I think it is fair to say, without any official endorsement, all of us in the medical school, become so convinced as to the value of this treatment that within the clinical facilities associated with the medical school one finds a very close adherence to the principles of treatment that the sister laid down. We differ with her as to some of her explanations as to why it worked, but we have not found reason to question and we fully believe in the success of this technique.

Now, that acceptance of the ideas of Sister Kenny—not only acceptance but a continuance in applying these methods on the patients in the university hospital and other hospitals associated with the medical school—has led over the years to a very close affiliation between the University of Minnesota Medical School and the Kenny Institute at Minneapolis. We recognize that on their staff they have medical persons of the highest quality and we have been very much pleased that we could, as the medical school, affiliate with them. The majority of their staff have connections with the medical school. Most of our staff who are interested in polio have similar connections with the Kenny Institute. For example, our chief of neurology has recently established a connection as a neurological consultant for the Kenny Institute. Our head of the department of physical medicine is one of the active members of the clinical staff of the Kenny Institute. The same connection is found with the head of pediatrics, and so it goes through the various fields of medical science that we have been working on. There is very close collaboration.

The fact that the medical school is doing so indicates that we strongly believe in the contributions that they are making. We look forward over the years that are ahead to even closer affiliation.

Now, this problem of poliomyelitis in the community is one that periodically rises to, may I say, haunt a health department which is responsible, after all, for the protection of the health of the people. We have recognized in the past that we have had no way of stopping polio.

I have been a health officer and there was nothing I could do to prevent an outbreak of polio. When it began it had to run its course.

I am not at this time going into debatable points that will come up later. The hearing this afternoon and next Monday, I understand, will deal with the value of vaccines and gamma globulin.

In the past, without pros and cons, we have had nothing. We have had to recognize that the only approach in polio—the administrative approach—was to try to prevent the damage from the disease; in other words, to minimize the ill effects. That is all we could do, acting collectively as a public-health agency. That is all I could do as an individual to protect my daughter. I have not been able to say I could do one thing and know she would be protected against it the way I could say in the case of smallpox or diphtheria, where I knew what to do to protect her.

We have had to fall back on the idea of treatment of patients with the full belief that if we could provide better methods of treatment—more available facilities for treatment—we could, to a large degree, take the sting out of the disease. It is not the disease that is impor-

tant; it is the effects of the disease—the crippling as well as the killing power. Merely having polio is of no consequence unless you get a serious damage to the central nervous system.

We have had to rely—and we still do, right to this day—on providing facilities. Our basic problem in meeting polio is the problem of providing facilities.

Now, providing facilities means many things. It means providing facilities for diagnosis so that we can help the physician to say: "This is poliomyelitis; that is not."

The diagnosis of poliomyelitis is not easy in many cases. I know this from years of experience, going back to the 1930 and 1931 outbreaks, when I had charge of the program in the State of Massachusetts. I was acutely aware of the need that physicians have for better ways to diagnose poliomyelitis. At that time, as a State health department, we were offering facilities for diagnosis. We were sending physicians and pediatricians around the State to help the doctor arrive at such a diagnosis.

Since that time, we have seen improved methods of treatment.

Our second problem, then, is that of providing facilities for treatment. In the case of poliomyelitis we need 2 or 3 types of facilities. We need facilities for hospitalization, and that means beds—beds in which to put our patients. We need nursing care, and as our methods of treatment become better, we need more nursing care.

I remember only too well the high death rate in the 1931 outbreak in Massachusetts. We lost about 10 percent of all our patients; many of the patients that we are saving today were dying at that time.

Now, saving them means two things. It means we have got to put more nursing care to take care of the acute cases, since present-day methods of therapy require more nursing care. It means, second, that these cases that formerly died are still in the picture and their treatment is having to go on and on. These patients need prolonged medical and nursing care. For 100 cases of polio today, we require a great deal more facilities for treatment than we did for 100 cases of polio 10, 15, or 20 years ago. We need actually more human help during the actute stage and we need many months—sometimes up into years, as Dr. Elwood can tell you—of actual treatment in order that that person can be restored to maximum efficiency, and that is what we are after.

There is another phase to this and that is the need for physiotherapists—persons who during the acute stage, during the convalescent stage and late stages, can work with these patients to help restore them to normal human function.

One of the key aspects of the Kenny treatment has been this provision of facilities for physiotherapists. By "physiotherapist" we mean application of physical procedures—not chemical and not biological but physical measures in the treatment of these crippling disabilities. We know that physiotherapy requires many personnel and requires intensive training of personnel so that they know how to apply this treatment, and it also means a constant flow of these trained persons to the various treatment areas so that there will be personnel available to carry on this work.

I said at the beginning that I see this problem from the standpoint of one who as chairman of the State commission in Minnesota has

been charged by the State health department with the responsibility for helping them outline their program and carry it out. We are faced constantly with this problem of finding facilities, finding beds for treatment of polio, and finding nurses.

In 1952 we had a lot of polio in Minnesota. Any night last summer I could have taken you into the Hospital of the Twin Cities and I could have shown you over 800 patients in the hospital with poliomyelitis. About one-third of those were in the Kenny Institute; they were providing facilities for the treatment of about one-third of the cases that were being rushed into the Twin Cities for treatment, and as it went on it got worse and worse. We passed the peak of that outbreak, gentlemen, but we have not passed the peak of the problem. We know that after the peak of that outbreak the public heaved a sigh of relief and said, "Now it is over." It was not over. We know that we have still in our hospitals the cases that were attacked in the early stages that are going to have to be cured and stay in our hospitals for many weeks and many months.

In the Twin Cities we have never, to the best of my knowledge, said to any patient "You cannot come into a hospital." I confess there have been many, many times when we wondered, seriously wondered, where that next bed was going to come from when the next call came from a poliomyelitis patient.

Minnesota is no different than any other community. Minnesota is not a polio State any more than any other State can be called a polio State. Minnesota is a cross section of the United States from the standpoint of poliomyelitis. It is a fact that we have been faced with this tremendous problem of trying to find qualified personnel to handle polio—medical personnel, nursing personnel, and physiotherapists—and we are faced with this problem of trying to train such personnel and trying to find beds in which to treat these patients.

In my mind, the great contribution of the Kenny Foundation—and as I said, and as Mr. Klein said, I have no official connection with it; I am on the outside looking in, but representing those who are faced with this problem of having it on a community basis—the great contribution that they have made has been twofold. To Sister Kenny goes the credit for her discoveries. The foundation does not claim that. They have, however, made and I think they are still making a tremendous contribution; first, in training personnel to cure these patients and to follow in the footsteps of the late Sister to carry out the treatment facilities and the treatment plan that she developed. Second, they are making a major contribution in actually providing facilities for the hospitalization for the long-term type of case.

Now, we have a great many problems unsolved. Dr. Elwood will tell you some of the problems from the medical standpoint and some of the problems that are presented by these long-term cases—cases that have developed that never existed before, because they died. With every step we make in saving lives, we make a more difficult problem for ourselves in having to provide for prolonged care and rehabilitation. Some of the polio-victims cannot be rehabilitated; some of them are going to be permanent cripples—permanent respiratory cases—and that is a big problem. Others are going to have limited development, and we have got the problem of rehabilitation on some of them in the hope that they can be made self-supporting. They do not want to be charges upon society; they do not want to have to go through this one

life that we have on earth—they do not want to go through that unable to support themselves.

Now, that, gentlemen, is to my mind, as I see it, the function and the great contribution that the Kenny Foundation has made and that it is making, and it is helping through the training of people for this type of treatment, and it is actually providing facilities whereby these people can be helped.

The CHAIRMAN. Thank you, Doctor. Are there any questions, gentlemen?

Mr. THORNBERRY. Doctor, may I ask this question? In view of your experience in public health, I was interested in what you had to say about the need for facilities for diagnosis. I have had an opportunity to observe a little about polio and particularly in one case that was very close to me, and I have wondered whether or not the lack of facilities for diagnosis or even the lack of the ability to make the proper diagnosis, has not been the cause of a great many severe cases of polio?

Dr. ANDERSON. I think I can say that the longer the diagnosis is delayed, the less is the likelihood that that individual can come out of the case with success and with completely functioning facilities. Now, mind you, there are a lot of mild cases. We know that. We know that of all the cases that get polio—get polio virus infection—only a few get paralysis. You have probably had polio and I have probably had it and most of us in this room have had polio in some form, but it was a very mild thing. Yet, we went through it and we did not know it. We probably had some little infection as a child but nobody put their finger on it and called it polio, but that probably immunized us from the more severe attacks. A great many of those cases are being missed today and there is no need of diagnosing them, but the ones you are referring to are ones that are going to be paralytic cases. They may have some sickness that may not be noticed by the parents at the time and may not be noticed by the physician at the time, and it may not be picked up until sometime later.

We have known that in all of our polio outbreaks at the orthopedic clinics and hospitals. We have continued after the outbreak to pick up cases into the next few months or into the next year or so which show orthopedic effects as a result of unrecognized polio which occurred some weeks or some months or some years earlier. Those are the ones we want to find and to help the doctor in making the diagnosis.

Put yourself also in the position of the physician, with all of the public—may I say hysteria about polio, and I think that is a correct term—with all the public apprehension. If you were the physician and you had a case about which you were a little bit uncertain, you would not want to be essentially sitting on the case. If it went wrong and there were some paralysis, you do not want to be in the position of having failed to make the proper diagnosis.

I referred to the State of Massachusetts and I referred to the fact that during the time I was there, I was charged with the Division of Communicable Diseases of that State for 6 years. We used to send out pediatricians to help make a diagnosis, and we sent them out at the request of the physician, so that any physician could say to us, "I have a questionable case; would you send somebody out to help me on this?" We sent them all over the State of Massachusetts, and after we had been doing that for a few years, we circularized the doctors

who had called for help of that sort and asked them if they wanted us to continue it as a help to them or did they feel that this was something they did not need and that they did not want the health department to be meddling with in the field of diagnosis.

Out of the many hundreds of doctors that had called for help and who responded to our questionnaire, we had just exactly one who said he wished we would discontinue it. All the rest of them wrote in that they wanted help—they felt as a physician in the city or in the rural areas—wherever they were practicing—that this help they could get for diagnosis was invaluable to them in their practice.

That pattern of sending diagnostic consultants out has not been followed in all States and I do not think there is any need for it in all States. We know that the doctors today are better informed on diagnosis, but there is still some need for help.

One of the types of help that we have seen set up in cities to assist the physician is that which the Kenny Institute has been conducting in Minneapolis. A great many of the patients have come into the institute for diagnostic purposes, and Dr. Elwood can tell you the percentage that turned out to be polio and turned out not to be. This procedure is also helpful in terms of teaching the doctors diagnostic methods. If we can only get a better and faster diagnosis, we will prevent some of these susequent paralyses.

Mr. THORNBERRY. May I ask you this: A while ago you referred to the fact we did not know the cause of polio, and therefore, had to rely on diagnosis—early diagnosis—to minimize the effects of it.

In your opinion are we spending enough funds and time in research to find out what the cause of polio is?

Dr. ANDERSON. Well, I think more money could be spent, and there are certain fields that have been emphasized more than others.

To my mind, and in my opinion—and I can express a personal conviction—in my mind the $64 question on polio is the question of why is it that this virus that is so mild for most people is so terribly serious for an occasional person? What is it about that individual that makes him respond badly whereas you and I responded well? I think there is a field for more experiment and a tremendous field for investigation. I am not criticizing the money that has been spent for the development of gamma globulin and the development of a vaccine. They are all highly valuable and have added immeasurably to our knowledge of the disease. I am not criticising anyone as to the theory of the presence of the virus in the body, but I do feel that in studying the human being and the causes of polio, we should seek to find the answer to the question of why someone responds badly, whereas most of us respond well. There is the field which I think has not been adequately explored and for which I think money could be made available.

Mr. THORNBERRY. The reason I asked the question is because I think you referred to "hysteria"—and probably that is the correct word—but I think the reason there is so much apprehension in the public mind is because there is a field in which the public feels that hardly anyone knows the cause of polio and the cause of epidemics—if epidemic is the correct term—and there is a feeling on the part of everyone that the medical profession and the sciences have been unable to solve the question as to the cause of it.

Dr. ANDERSON. We know what causes it in terms of certain organisms. We know there are three strains of viruses and we have had the viruses in captivity for many years.

Mr. THORNBERRY. How is it communicated?

Dr. ANDERSON. There are different ideas on that. I think one can say that there is fairly general agreement today that it is passed from person to person and whether it is an intestinal or respiratory spread is something to be determined.

Mr. THORNBERRY. You say there is now general agreement that it is spread from person to person?

Dr. ANDERSON. Yes, sir; I think I can say there are relatively few people that will differ with that. Some persons might, but I think you will find a fairly general agreement on the question of its spreading from person to person.

Mr. THORNBERRY. Now, I want to be sure about this. Do you mean that if you have a known case of a person who has poliomyelitis, that that person is apt to communicate that disease to another person?

Dr. ANDERSON. Yes, sir; spread it during the early stages of the disease.

Mr. THORNBERRY. In the early stages?

Dr. ANDERSON. Yes, sir, early stages of it. I think most of us would go along that line.

What you are referring to is the fact that many persons have talked about its spreading through insects, water, swimming pools, and the like.

About 5 years ago, I believe it was, the National Foundation set up a committee to advise them on methods of control of polio. The findings of that committee were picked up by the American Public Health Association as part of their little manual, on which they are now in the seventh edition, on the control of communicable diseases. I had the privilege of being a member of that committee, and I have always been one of those who have held personally to the belief of a respiratory spread. Some people have not agreed with me, but the significant thing to my mind was that it worked out. In working out about a 2- or 3-page statement, it took us no longer than 5 minutes to find general agreement on that committee to the statement that all the evidence indicates that poliomyelitis is spread from person to person. Then it goes on in another sentence and says, "There is evidence to indicate spread through water, milk, flies, or food."

Now, I was amazed that we could get into an agreement that quickly, because we had there in the room some of the persons who had been the most ardent proponents of spreading by other means. I realize that there are some people still talking in terms of water. I saw a news release the other day from Italy from a meeting in Rome, at which they referred again to an intestinal spread. I think in this country one can say there is a fairly uniform opinion of a spread from person to person, but, as I say, you will find differences of opinion as to whether that is intestinal or respiratory.

Mr. THORNBERRY. Yesterday the chairman pointed out that the first person who testified usually had most of the questions asked of him. I do not want to take up all the time and prevent questions from the other members, but may I ask this additional question:

You said that in your opinion it was a person-to-person problem, and in your opinion respiratory, but you further stated there was disagreement in that field.

Would you say that the communication of the disease is comparable to the communication that comes from diseases subject to quarantine?

Dr. ANDERSON. I am not sure just what you mean. I would envision that poliomyelitis spreads in the body mechanisms in a manner very similar to the spread of measles, is that what you mean by a disease subject to quarantine?

Mr. THORNBERRY. The point I am trying to make is that I have just never seen a quarantine for poliomyelitis. In other words, other people are permitted to visit the stricken patient.

Dr. ANDERSON. We do carry on some isolation of the patient. It is the general practice around the United States at the present time to isolate patients for about a week, since we have evidence that during the early stages of the disease they are likely to pass on the disease to other persons. On the other hand, we recognize that while we do carry on that isolation over a period of a week, or 2 or 3 weeks, for every patient we put in isolation there are hundreds who are having a mild form of the disease that never comes to attention. So what we are doing actually is isolating only those few who respond. We are not isolating those who respond well, but who are just as likely to pass on infection to other people, so far as we can determine. So, essentially, on a communitywide basis, we segregate such a small fraction of cases that we do not accomplish anything in the way of stopping an outbreak.

We may protect a certain individual. If you and I were neighbors and my child had polio and your child was a playmate of my child, there would be some individual protection for your child if I locked mine up, yet your child would be perhaps just as likely to catch it from an unrecognized source.

Mr. THORNBERRY. In your opinion can a person be a carrier of the virus without being aware of it?

Dr. ANDERSON. Yes, sir; we have seen plenty of cases of that sort in which we can find the virus among other members of the family and associates of the individual and find that they are giving them the virus and therefore are in a position to pass on the infection to other people.

Mr. THORNBERRY. I am going to ask just one more question and quit.

Is it easy to explain the theory that it is a communicable virus from person to person in view of some of the epidemics that you have in different communities?

Dr. ANDERSON. Yes, sir. Let me give you one incident and a story on that. We had a case in Rochester, Minn., about 3 years ago where there was a family picnic. One family came from Rochester and one from northern Wisconsin and one from southern Wisconsin. They were all related and came over to have a family picnic on a Sunday. The only time they saw each other all summer was this 3 or 4 hours at which they were together at the picnic. One of the children of the Rochester family was not well that day, but, after all, the youngster did not like to miss a picnic, and it was because of the picnic that they all were there together that day.

The child was worse after the picnic, and within 3 or 4 hours after the picnic was over the two visiting families—one from northern Wisconsin and one from southern Wisconsin—went back home. That night the child of the Rochester family was worse, and the next morning a definite diagnosis of poliomyelitis was made. Twelve days later a case of poliomyelitis developed in the family in northern Wisconsin, and another developed in the family in southern Wisconsin.

They had been brought together and the children were playing with this child who was not very well, but was able to drag around at the picnic. That is the same thing you might see in measles or scarlet fever. The visiting children had been associated with a child sick with poliomyelitis, and after the end of the incubation period, they, too, came down with it. We can show that time after time. We cannot show it in all cases, because so many of the cases are picked up from infections from the outside and from those with a case so mild that it is unrecognized. We have persons who have no symptoms at all as they go through a period of virus infection. But we have so many cases which develop as a result of association which demonstrate the number of unrecognized cases. I think we can say we can look upon it commonly as a disease communicable from person to person, and we treat it accordingly. We recognize that our isolation precautions do not bring about a complete control, because they are applied to such a small fraction of the total reservoir of cases.

Mr. THORNBERRY. Thank you very much.

The CHAIRMAN. Are there any further questions?

Mr. DOLLIVER. I just want to say that I am aware of the great contributions which have been made by Sister Kenny, and I know of her contributions to the curative methods of this disease.

As I understand it, Sister Kenny developed her methods almost by instinct while she was serving as a public-health nurse in the wilds of Australia?

Dr. ANDERSON. It was partly instinct and partly a matter of necessity. She was faced with having to do something for these cases.

Mr. DOLLIVER. It was almost a stroke of genius that she discovered this method of manipulation and other means for the healing of this very disastrous disease.

Dr. ANDERSON. I think we can call it that.

Mr. DOLLIVER. The Sister Kenny Foundation, as I gathered from Mr. Kline and from what you have said, was set up to advance and to publicize within the medical profession the healing art and the methods that were used by Sister Kenny; is that correct?

Dr. ANDERSON. Yes, sir; and to cure polio victims and to make the methods available to patients.

Mr. DOLLIVER. And to improve them as it was possible?

Dr. ANDERSON. Yes, sir.

Mr. DOLLIVER. And that has been the main and principal function of the foundation?

Dr. ANDERSON. That is right.

Mr. DOLLIVER. Now, the research to which Mr. Kline referred—I think he said it was not one of the important activities, but it was more or less incidental to the healing work that you have promoted?

Dr. ANDERSON. Research is constantly going on, both in terms of subsidized research—the work of Dr. Jungeblut is an example of the

research that is being supported—and also research within the Institute in terms of improving methods of treatment.

Dr. Elwood can tell you of some of the studies that are going on there which we did not want to stop when Sister Kenny died.

She made an invaluable contribution, but there is still more that has to be done, and Sister Kenny scientists are constantly trying to improve that. Sister Kenny's basic interest was not the respiratory case, but as the foundation serves these cases it runs into new problems.

Mr. DOLLIVER. You do not reject any other proven method for treatment of this disease, do you?

Dr. ANDERSON. Oh, no; nobody is rejecting anything. We simply think that here is a method that has been demonstrated better than some other methods. Basically, when you strip it of all the controversial aspects—and I say, without going into the Sister's explanation, and I would not accept her explanation as to why it worked and I do not think many people today accept her explanation—but stripped of all that controversial aspect, the Sister did not bring anything basically new other than trying to bring together facts which we all knew about and focus them upon this patient. We know about the beneficial effects of heat, but she conceived the idea of the spasm-of-the-muscle treatment and the relief that the heat would give to that spasm. Her methods of physiotherapy are standard methods of physiotherapy and so is her muscular treatment about which we know. But she brought all these things together. Granted, she did not have all the treatment facilities that some of our physicians have had, she had to work out a lot of things, but there was nothing radical in the method she brought out. She did, however, focus them upon the polio cases and we think we got better results that way.

Mr. DOLLIVER. Of course the facts are, and the record is, that many of the cures and improvements that have been witnessed by the use of her methods are nothing short of spectacular. Is that not true?

Dr. ANDERSON. I have seen such cases that I would put in that category.

Mr. DOLLIVER. We should not reject or even question any procedures which can bring about that kind of results, even if the percentage is not 100 percent.

Dr. ANDERSON. That is right. If my daughter had polio, she would have the Kenny treatment.

Mr. DOLLIVER. To get to another aspect of your testimony, you say the viruses have been identified for a good number of years?

Dr. ANDERSON. Oh, yes; I think it was in 1912, if I recall the date, that Dr. Flexner demonstrated the existence of poliomyelitis virus. We have had the virus in captivity for years, and we still have at the laboratory the 1916 virus which came out of the very disastrous 1916 outbreak, one of the worst things we have had occur in this country. We have kept them in an experimental animal for these many years.

In recent years we have come to realize that there was more than 1 virus in the cases of polio and that there were 3 different strains. We refer to them as type 1, type 2, and type 3, and recognize that they are not alike; they all produce paralysis; they all produce the same picture in the individual; but, unfortunately, infection with type 1 virus does not protect against infection with type 2 or type 3. So I may have 1 type and be subject to attack from the other 2 because the body can contract all 3 types. All the viruses which have been isolated can

be lumped into those three categories. It may be that some time we will come up with a fourth type. We recognize that the germs which cause pneumonia are of probably 50 different types of pneumococcus as well as the different types which cause meningitis. In these diseases we know of a great many types. That is characteristic of bacteria.

Mr. DOLLIVER. I notice you use the expression "germ" and also the term "virus." Are those interchangeable terms?

Dr. ANDERSON. No, a virus is a type of germ. The word germ has no scientific meaning; that is a popular term, but we speak of a microorganism.

Mr. DOLLIVER. Is a virus a living organism?

Dr. ANDERSON. So far as I know it is; it is right on the fringe, and that is a nice question. We know it can multiply, and to the extent it would multiply, that would be our definition of life. But we are right on the fringe of what is life in connection with this particular organism.

Mr. DOLLIVER. But, being able to reproduce, is a characteristic of a living organism, is it not?

Dr. ANDERSON. Yes, sir, so far as our ordinary thinking; yes.

Mr. DOLLIVER. Does it have the power of mobility?

Dr. ANDERSON. Probably not. It is so small we cannot see it and we recognize it by the effects of it and not being actually able to look at it; it is ultramicroscopic.

Mr. DOLLIVER. Is it a filterable virus?

Dr. ANDERSON. Yes.

Mr. PRIEST. Would the gentleman yield?

Mr. DOLLIVER. Yes.

Mr. PRIEST. There are one or two questions, Dr. Anderson, which I would like to ask.

Are there any other training centers in the country where nurses may receive such training or physiotherapists may receive such training in the Kenny technique other than the Kenny Institute?

Dr. ANDERSON. I would like to have Mr. Kline answer that question. There are plenty of places where they are being trained and whether you want to say they are trained in the Kenny technique or some part of it, I think Mr. Kline can answer that.

Mr. KLINE. I think the answer to that, of course, is that there are many physiotherapy schools. We take the graduate physiotherapist, the same as the registered nurse, and give them 2 years of intensive work in the Kenny method. They take 4 months of diadactic work and they go through 2 polio seasons and they work under the supervision of doctors and there is a regular course for them. They achieve a certificate upon graduation and then we feel they are no doubt the highest polio specialists in the use of the Kenny treatment method. Minneapolis is the international training center, and we do, after a certain period of time with the students, send them to Jersey City Medical Center, where we have a Kenny Institute, and also to Del Monte, Calif., and hence to Michigan and Chicago and other places. We have what we term Kenny doctors and graduate therapists who supervise their continued study on the practical phases of the work.

Mr. PRIEST. Now let me ask you this question: What is the educational minimum or the educational background for a physiotherapist;

that is, in order to take one of these courses in this particular technique?

Mr. KLINE. They have to be a graduate of a physiotherapy course and have a certificate, the same as with a nurse.

Mr. PRIEST. It is along the same line as the graduate nurse?

Mr. KLINE. They have to be a registered nurse before we take them and they have to meet other standards that we have set up.

Mr. PRIEST. I believe that is all for the time being, Mr. Chairman.

The CHAIRMAN. Did you say that Jersey City Medical Center is one of the places where they are training and instructing people in this technique?

Mr. KLINE. Yes, sir. It is not the entire Jersey City Medical Center. We have two floors that are devoted entirely, under the direction of the Kenny Foundation, to the administration of the Kenny treatment. We staff it medically and otherwise. At that institution we do supply them with training over and above the regular graduate Kenny therapy and we do have some of our students who come from the eastern area who get their additional practice and training at the Jersey City Medical Center at the Kenny Institute there.

The CHAIRMAN. I have heard it very highly spoken of and considerable commendation has been given by the authorities at the Jersey City Medical Center who are interested in the subject.

Mr. KLINE. We have a very fine arrangement at the medical center.

Mr. HESELTON. Mr. Kline, those of us who were on the committee in 1948 will recall your testimony and Sister Kenny's testimony and that of certain officials of the National Foundation for Infantile Paralysis, but as I recall there was a rather sharp difference of opinion in regard to this program.

Could you briefly tell us what happened with reference to the conference and anything else in terms of the relationship between the Kenny Institute and the national foundation?

Mr. KLINE. Well, I think some of you present will recall, as you mentioned, that at the time we appeared here in 1948, and leading up to that and some time after that, there were at times, shall I say, clashes.

Mr. HESELTON. There were what?

Mr. KLINE. Clashes, particularly between the Sister and some of the viewpoints of the national foundation. But throughout these years, we have found each year that we get along better. I think that both organizations realize that we have our own program. In fact, in many cities where we conduct hospitals and have Kenny institutions, we have found that there is agreement at the local level and at times we probably implement each other's programs. They have a very definite program and we have a very definite program. I think as time has gone on we have found more and more of a common understanding and a better, shall I say, working relationship. It varies in various sections of the country. I think most of that is due to the feeling which you have with any organization which is dealing with human beings. They have various approaches to things, but as I mentioned before, I find that we are working in closer harmony, and I think both our programs are important. I think as time goes on we can work closer and closer together to improve the feeling which formerly existed.

Mr. CARLYLE. Mr. Heselton, would you bring out for the benefit of those who were not on the committee in 1948 the fundamental difference between the national foundation and the Kenny Institute?

Mr. HESELTON. As I recall, there were two main points of difference. First, there was a conference to be held at that time, and the officers who were arranging the conference did not permit Sister Kenny to show the film which was shown to the committee, along with other documentary evidence of the Kenny treatment and what it accomplished. The hearings were held before the conference, so I do not know whether Sister Kenny appeared at the conference or whether she had the opportunity to do so. Then, too, it was claimed that the foundation at that time was not contributing to the Kenny Institute. I understand that Sister Kenny had withdrawn from the faculty of the University of Minnesota and applied for research grant funds, which were denied on the ground that research programs were not a part of the Kenny Institute's regular program.

As I understood it, there were many other differences, but those two stood out in my mind as the main ones at that moment.

I do not know if I have stated the situation correctly, but could you advise us as to whether the institute is receiving any assistance from the foundation and whether the Institute was finally permitted to show the film at that conference or subsequent conferences?

The CHAIRMAN. Before you do that, will you make plain what is meant by "conference" and with whom it was held?

Dr. ANDERSON. I think Mr. Kline can probably state that better than I.

Mr. KLINE. Well, gentlemen, in the first place, I do not want to be placed in the position of rehashing too much of the past, shall I say, pioneering efforts which went on. Possibly some of our efforts at times were wrong. There have been these clashes that were referred to. Sister Kenny in her own right and her own way had an approach that I did not see eye to eye with, nor did a number of our doctors. I do not think any of us are smart enough to say she was wrong, because she did a great job.

Mr. CARLYLE. May I interrupt you right there, to see if I am correct on this: The traditional method of treatment of acute poliomyelitis at that time and before the initiation of Sister Kenny's treatment was to place in a plaster cast or by other means immobilize the patient for treatment. She, on the other hand, believed that the heat treatment and the muscle work was the key to successful treatment.

Mr. KLINE. Well, I think that is pretty well true. I think the doctors will probably bear me out that prior to 1940 and the Sister's coming to America, they had what they used to refer to as the orthodox method, and it was pretty generally accepted in the hospitals throughout the country. But those cases were probably not diagnosed as early as they have been since, with all this publicity and the part that Sister Kenny played and the national foundation and others. They did not hospitalize them as early or as long as they do today. They put them in plaster casts, splints, and braces earlier. Sister Kenny felt that there were other ways of taking care of them through this muscular treatment; hot packs are only a part of the Sister Kenny program.

It has been recognized, I think, by the medical profession and by the national foundation that Sister Kenny made a tremendous con-

tribution. Over and above that, you can get into various arguments, depending upon whom you are talking to. Generally, it is accepted, I think, so far as the point you were referring to back in that other hearing is concerned, that the Sister was always impatient; she was going 24 hours a day, 7 days a week; she lived and slept polio; and whenever there was a conference, whether it was in Chicago or Podunk, she was insulted if someone did not invite her. She wanted to be every place, and if she was not invited to conferences held from time to time among the medical men, she would be insulted. Personally, sometimes I think—and I hate to say this—but she probably sometimes used such meetings as a sounding board to emphasize her phase of the work. She was always asking for a conference, whether it was with the public health authorities nationally or at the State level, or with the medical associations or the various professions among the medical group, and they did not always see fit to accept her. However, she generally was treated very cordially by most of the medical groups and organizations. At the times when she was invited, she was received very well. I know some of them did not agree entirely with what she was saying, but all in all, while she was still living they gave credit to her for crystallizing and focusing attention of this present approach for the treatment of polio.

The CHAIRMAN. When Mr. Heselton spoke of a conference, I thought he might have had in mind the conference which was to be held between Sister Kenny and Dr. Scheele, because in the hearings—and I have just tried to find it again—I saw it this morning as I thumbed through these previous hearings—there was an indication that they were to hold a conference. Dr. Scheele had expressed a willingness to do so, but indicated that on account of other engagements, he could no do so that afternoon. However, the conference was to be held, and the committee asked that it be informed as to the results of that conference. I did not know whether that was what Mr. Heselton had in mind in the use of the word "conference." Maybe he did not have that in mind.

Mr. KLINE. That was referred to at that meeting as I recall. Quite a coincidence occurred last night; while I was coming from Minneapolis, I met Dr. Scheele on the plane coming in from Detroit, and we had a very nice visit with him. I did not attend the conference with the Sister, but shortly after that day the Sister did have a meeting with Dr. Scheele, and they had a very fine discussion.

The CHAIRMAN. There was also made a part of our hearings at that time a report by Sister Kenny with respect to her visit to many countries, including England, Ireland, France, Belgium, Sweden, Russia, Norway, Denmark, Germany, Switzerland, Italy, Spain, the Netherlands. The report that she gave in regard to her reception in those different countries was very interesting, and we made it a part of our hearings which were conducted in 1948.

If any of you are interested, you can get a great deal of information about the Kenny Foundation which was given by Sister Kenny herself in those hearings which were held back on May 13, 14, and 19, 1948.

Mr. KLINE. I might just fill in briefly, Mr. Chairman.

Mr. HESELTON. Before you do that, the chairman brought back to my mind that conference, and it is established in the record that there was a conference between Dr. Scheele and Sister Kenny. In using

the word "conference" I had in mind that portion of the testimony that was addressed to the so-called international conference. I find here it was in the record. I would like to put in the record a copy of a letter addressed to you:

In reference to your letter of March 4, addressed to Mr. Basil O'Connor, and Dr. Hart E. Van Riper's letter of March 15 in answer to your letter, I should like to advise you that at the last meeting of the advisory committee for the First International Poliomyelitis Conference, the committee says it is impossible for us to evaluate your presentation with the amount of available knowledge, published or otherwise. We would, therefore, ask you to submit a plan and state what your contribution would be in reference to your letter.

As the chairman has indicated, the committee did have quite extensive hearings, and with reference to showing of that film, it seems to me that it would be helpful to the committee record to know what transpired after the hearing closed with reference to that particular conference and whether she was permitted to make such demonstration as she wanted to at the conference or not.

Mr. KLINE. I guess I will have to say that she was not.

Mr. HESELTON. Generally you say that understanding has improved since that time?

Mr. KLINE. Yes; and that is a point I mentioned earlier. I rather hate to rehash some of the past history, because on the general acceptance, which is the important thing, the Sister at times was her own worst enemy.

As I have already said, God bless her, she did things that nobody else could do apparently, but she was on the threshold at times of having all the acceptance and then because she was impatient, she would sometimes defeat her purpose and our purpose. I think more important is the fact that the University of Minnesota Medical School and leading medical men throughout this country and throughout the world have endorsed and acquired a working evaluation of the Sister Kenny method and practiced it, are teaching it, and are following it to the best of their ability. So that, I think, in memory of Sister Kenny, is the best that she could ever want. One point I want to follow up with, since I am on that subject, is that in deference to her wish on her deathbed I went over to Australia last March. As you may know, or perhaps do not know, the Kenny method was not followed in her own country as it is followed over here today. A portion of that was because of the many clashes between the Sister herself and some of the doctors. They had a lot of respect for her, but she was a stickler.

However, we know as a result of that trip, at the international training center now there are orthopedists spending 3 months in learning the Kenny method and going back to practice in the Brisbane General Hospital in Australia. This was all set up by the leading medical men of Australia.

Also we have at the present nursing therapists and 1 head therapist of a general hospital who practiced for 10 years taking the Kenny course. Also Miss Flowers, a teaching M. D., is to be sent to the Kenny Foundation so she can teach it in Australia.

There is a committee of doctors from Australia headed by Dr. Abe Fryberg, director of public health of Queensland Province; Dr. Stubbs Brown, president of Queensland BMA; Dr. Nye of a clinic in Brisbane; and Dr. Pye of Brisbane Hospital. Those are the members of a committee of M. D.'s from Australia. Men of that caliber

are on committees and teaching orthopedists, and men from the universities come over to learn the Kenny method so that they, in turn, can go back and teach it in Australia.

Mr. HESELTON. Has the institute received any financial assistance from the foundation since that time?

Mr. KLINE. We struggled along for years with various ups and downs. We are not asking for any funds.

Mr. HESELTON. You are able to get along yourselves on your own?

Mr. KLINE. Yes, we are able to get along through the generosity, of course, of the public, but over and above that it is not a part of our program to ask for grants as long as we are financially solvent.

They do, however, in some of our hospitals pay for the hospitalization and treatment of the patients. The Kenny Foundation provides Kenny treatment free of charge to anyone. That is for the medical and the actual therapist's care of the patient.

However, in some places, due to local situations which prevail there, that is not true.

Michigan is one illustration, and New Jersey is another. They carry on and do the job.

Basically, we are not quarreling; we are getting along and improving as rapidly as we can, because it depends upon the number of physical therapists, and it depends upon the number of nurses that we can get as to how fast we can expand.

You gentlemen, I am sure, realize that there is a shortage of physical therapists and nurses not only in this country, but throughout the world.

There is one other point I would like to touch on in the connection that Congressman Wolverton referred to, and I do not think the Sister made a report on it to you.

Two of our therapists were behind the Iron Curtain in Czechoslovakia at the request of the public health authorities over there.

As a result of that trip, they conducted seminars for 3 weeks with 50 doctors attending, and for 6 months with some 200 nurses attending, and they gave the Kenny treatment to those behind the Iron Curtain when other people could not get through.

I think she was a great goodwill ambassador for America around the world.

Due to our crusading and traveling at the Kenny Institute international headquarters, we have trained nurses and physical therapists and doctors from practically every country in the world throughout these years.

In the present class we have them from Germany, from England, from Australia, and from Canada, and we have had them from all of the other countries.

We have had a half dozen doctors from some of these countries to learn the Kenny work.

Mr. HESELTON. How long a course is that training?

Mr. KLINE. Two years, and we furnish a scholarship.

Mr. HESELTON. How long has the institute been in operation?

Mr. KLINE. Kenny Institute as it is known, was set up December 17, 1942, and is still run by the city of Minneapolis, and in 1943 the Kenny Foundation was formed and took over the operation of the out-patient clinic and has admitted outpatients.

Mr. HESELTON. About how many people from the United States have you trained?

Mr. KLINE. Well, I would say it would be in the hundreds. When you speak of doctors it is over 100 people that have been fully trained and become graduate Kenny therapists.

Mr. HESELTON. And they, in turn, are equipped to teach the method?

Mr. KLINE. They help in both teaching and treatment.

Mr. HESELTON. How far reaching is it in this country? Is it in every State?

Mr. KLINE. No, sir; it is not.

Mr. HESELTON. In about how many States is it?

Mr. KLINE. At one time we organized 32 States. In 1946 we realized we were getting a great lead on the areas, in other words, that we did not have enough trainees and trained people to meet the so-called demand, so we retrenched, and now we only campaign in areas where we do provide patient treatment, where we have these treatment centers located in various sections of the country.

Mr. HESELTON. In about how many States?

Mr. KLINE. In California, both northern and southern, New Jersey, and New York, in New York City, and in Buffalo, N. Y., and there is a treatment center in Michigan. It has been located in Pontiac, Mich. Now it is being moved to Children's Hospital, which is located just outside of Detroit.

We have treatment centers in Chicago and Des Moines, Iowa, and last year we had one down in El Paso, Tex.

We did not have much polio down there this year. We have been sending out a number of our trained personnel, making them available for epidemic aid where there is need for additional personnel.

Mr. HESELTON. How about Massachusetts, do you do any work there?

Mr. KLINE. No; we do not have any in Massachusetts.

Mr. DOLLIVER. Will the gentleman yield?

Mr. HESELTON. Yes.

Mr. DOLLIVER. I heard you mention Des Moines, Iowa. In connection with what hospital is that carried on?

Mr. KLINE. It is carried on at the Blank Memorial and Lutheran Hospital and Sister's Hospital.

Last year we had 7 therapists there and these 3 hospitals were loaded. This year we have two therapists there.

Mr. DOLLIVER. I would like to ask another question of Dr. Anderson. I seem to find a difference of opinion as to whether this is a recurring disease. I know about an incident which occurred in the summer 1 year ago when a woman was apparently stricken with all the symptoms of polio, but did not have any involvement of any limbs or of the breathing apparatus, and the symptoms quickly disappeared under proper treatment and proper supervision.

Does that mean that from now on that individual will be free of polio, or could there be a recurrence of it at a later date?

Dr. ANDERSON. If we assumed that upset which she had was polio, we would have to classify that as a periphic case.

If that had been polio, that woman would in all probability have been resistant in the future against that particular strain of virus that caused this upset.

Now, let us assume that it was type 1 polio, she would be resistant to it in the future but not against type 2 or 3.

Mr. DOLLIVER. Thank you.

Mr. KLINE. Mr. Chairman.

The CHAIRMAN. Mr. Klein.

Mr. KLEIN. Let me see if I can sum this up. As I see it the difference between the two foundations dealing with polio is that the National Foundation has been using other methods than the Kenny Foundation, they have never accepted the Kenny method as the best manner of curing polio; is that correct?

Dr. ANDERSON. I do not think I can say that the National Foundation is using any methods as such. They have endorsed certain methods at Warm Springs, Ga., and I think when you get down to it that there is not too great a difference there. It is a matter more of a relative difference.

Mr. KLEIN. What?

Dr. ANDERSON. It is a matter more of a relative difference. Mr. Heselton referred to the old days in polio when you used to put a patient in bed immediately, putting a splint on, and the practice was not to take the splint out, not to take a chance just because a child could walk without the splint, because they could burn out the leg by so doing, so he was kept immobile.

Now, what the Sister brought in was to get away from this immobilization, to get a gradual amount of movement or mobility, starting in with passive motion and then gradually more motion.

Splints still have their place, but there will be differences between physicians as to the use of them.

I think some of the people at Warm Springs put a little more reliance upon splints than Sister Kenny, but, on the other hand, a great many of the Kenny converts are using splints. It is a matter of relative reliance upon these methods.

Mr. KLEIN. Is it possible to get, or are there any statistics on the question of the percentage, let us say, of people that have polio that are treated by the Kenny method and those treated by any other method? Are there any statistics of that kind?

Dr. ANDERSON. I do not know of any statistics on that. I could not say how many are treated by the different methods. I think it would be impossible to get those statistics, because there have been varying extents to which the Kenny concept has been accepted.

I think you will probably find generally that heat and packing is being used today in the treatment of polio.

There is a difference of opinion among physicians today as to whether or not heat and packing is of therapeutic value or whether it merely affords relief of the symptoms, but I think you will find a big number of the patients in the United States today are receiving heat packs. This is the Kenny concept introduced into the treatment.

Mr. KLEIN. Are there any statistics on the number of people treated by the Kenny therapists, or by people trained in the Kenny Institute?

Dr. ANDERSON. I suppose that they could be found. I do not know whether any figures have been gathered on that or not. I do not know whether Mr. Kline knows of any or not.

Mr. KLINE. We have had facts and statistics, and there has been a gradual increase in appreciation of the Kenny method, both through the direct results we get on polio patients and because of the indirect

benefits accruing by maintaining these high standards, which are untold.

We do not know how far they have gone in their influence on polio since 1940 when the Sister started off, over and above what she did directly. The indirect benefits throughout the world are tremendous.

Mr. KLEIN. Yes; I understand that.

Perhaps this would be an easier question to answer. The therapists who are trained by the Kenny Institute are employed, I believe you said, in helping to teach the Kenny method and in the treatment of patients. Is that correct?

Mr. KLINE. Yes, sir.

Mr. KLEIN. Where are they employed, in public institutions or only in the Kenny institutions throughout the country?

Mr. KLINE. They are employed in the Kenny institutions. We want to train as many of them as we can.

Mr. HESELTON. Will the gentleman yield for a moment?

Mr. KLEIN. Yes.

Mr. HESELTON. I find that Sister Kenny said when she testified here:

> My treatment was treating that part of the body which was disturbed by the disease and previously unknown to be disturbed, reducing the pain and shortening of parts, and in doing so the opposite part which was supposed to be paralyzed was easily reeducated to activity and functionability. I am not saying it is 100 percent recovery. It is not 100 percent recovery. But, according to the statistics which appeared in the Indiana Medical Journal of December 1942, the recoveries of the Kenny method of treatment are 66 percent more in America than they were before.

Mr. KLEIN. What I was trying to get, if I could, was the wideness of the use of the Kenny method in this country as compared to the other methods which are used.

Mr. KLINE. Well, of course, the patient in any hospital is under the direction of the doctor. Now doctors in various hospitals, and even some of the doctors within the same hospital, have a little bit different approach, but I think, generally, that it is safe to say that they are at least in varying degrees following some Kenny method. The same tools are doing a very good job.

Mr. KLEIN. But they are not using the people that you have trained?

Mr. KLINE. Well, in the other hospitals we have not been able to get enough to train. If we had several hundred more Kenny-trained polio therapists, we could use them very easily, and other hospitals would want more of them. Just last spring Dr. Van Riper, medical director of the national foundation, said that it is a shame that there are not several hundred more Kenny-trained therapists.

Mr. KLEIN. I happen to be a member of the board of the Willard Parker Hospital in New York City, which is one of the largest contagious-disease hospitals there. I know that we have no therapists trained in the Kenny method. I was just wondering how generally that condition exists.

Mr. KLINE. Dr. Elwood was in Willard Parker this spring. There have been doctors from that hospital in the past who have been out to Minneapolis, among them Dr. Kline. There has been a number from Willard Parker and from other hospitals in New York that throughout the years have attended these medical seminars on the

method and believe in it and are trying to follow it to the best of their ability.

Mr. KLEIN. Here is the $64 question: Could you use more funds, and in that way do you think you might be able to train more people who could teach that method of dealing with polio?

Mr. KLINE. We never want to appear any place and say that we cannot use more funds, as, of course, we can.

I think the $64 question in all this public health matter is that somebody has to do something about getting more nurses.

We have to train more nurses, not only in polio, but in all fields. It is not only to have nurses trained as specialists in polio, but in treating all the cases in the hospitals you need nurses. There is a dearth of nurses, I dare say, in every hospital in the United States today.

We are sometimes limited with our trained personnel to take care of more polio cases because we cannot get enough nurses, and that is true throughout the world.

So, I think that is the big problem confronting the hospitals, public health and the medical people, and all of us, to get more nurses and physical therapists.

Mr. CARLYLE. Mr. Chairman.

The CHAIRMAN. Mr. Carlyle.

Mr. CARLYLE. Dr. Anderson.

Dr. ANDERSON. Yes, sir.

Mr. CARLYLE. To me this is a new study, and I should like to ask you one or two fundamental questions.

How long has the medical profession known that there was such a disease as polio?

Dr. ANDERSON. It was first described in about the middle of the last century. We saw studies during the latter part of the century in Sweden and in Germany, and in this country the first description of polio was during the last decade of the last century.

It is quite obvious in going back that the disease is much older than that, but we did not sort it out from other diseases until the last century.

Mr. CARLYLE. In which country was it first discovered?

Dr. ANDERSON. It might be Germany or Sweden.

Mr. CARLYLE. In this country about when did it become a real problem?

Dr. ANDERSON. If I may go back to the other side, there was an outbreak in Berlin about 1897, I believe, which was recognized as an outbreak. Massachusetts had a bad outbreak in 1907 and another one in 1909 and another in 1910. The 1910 outbreak spread to the Midwest, and we had a worse outbreak in 1910 in Minnesota than ever since.

Those outbreaks did not attract very much public attention. The first outbreak to really attract much widespread attention was the 1916 outbreak in New York City, an outbreak that spread from New York City all over New England and out into the Midwest. That was the most dramatic outbreak we ever had of the disease.

Mr. CARLYLE. Doctor, about when was enough public interest generated in this country to cause a real fight to be made on polio?

Dr. ANDERSON. There was the Harvard Infantile Paralysis Commission which was organized in the early twenties shortly after the

1916 outbreak. There was a commission set up to carry on investigations in polio. They actually carried on surveys in Children's Hospital in Boston, and under the direction of the late Dr. Trask they carried on some diagnostic service which they carried on up to 1931, and they carried on a program of distributing serum to the doctors, and there was a program instituted, or a commission for the collecting of money for it.

You might say it was a very modest attempt, but it contributed a great deal to the research knowledge in this field. In the thirties we saw more attention paid to it. We had a bad outbreak in 1931, which up to that time was second only to the outbreak of 1916, and then you recall the dramatic episode of the polio of the late President Roosevelt, focusing more attention on it, and finally the building up of the tremendous amount of nationwide attention focused on it by what started out as the President's Birthday Ball, the March of Dimes, and the national foundation.

Mr. CARLYLE. Doctor, has it always been called polio in this country?

Dr. ANDERSON. We called it infantile paralysis. Polio is an abbreviation of the scientific name for it.

Mr. CARLYLE. Well, is it related to spinal meningitis?

Dr. ANDERSON. No; it is a very different disease. However, they both attack the central nervous system.

Mr. CARLYLE. It does attack the spine?

Dr. ANDERSON. It attacks both the brain and the spinal cord, not the spine.

Mr. CARLYLE. Let me ask you this: when a case of polio is detected in a patient, about how long does it take for it to run its course?

Dr. ANDERSON. You mean for the febrile disturbance to run its course? You mean before it reaches its peak?

Mr. CARLYLE. No, to run its entire course.

Dr. ANDERSON. It is pretty hard to say when the disease has run its course. Of course, residual paralysis is part of the disease, you know.

Mr. CARLYLE. I mean when the average patient is found to have polio, about how long does it take for that patient to either become permanently crippled, or die, or to recover?

Dr. ANDERSON. By recovery you mean on the mend?

Mr. CARLYLE. That is right.

Dr. ANDERSON. You say although there is still paralysis there?

Mr. CARLYLE. That is right.

Dr. ANDERSON. That is a matter of a week or 10 days, usually, maybe 2 weeks, it is an acute infection.

Mr. CARLYLE. Doctor, please give me if you will, the initial, or primary symptoms of polio?

Dr. ANDERSON. May I refer that question to Dr. Elwood as a clinician. I think he could tell it more accurately than could I.

Mr. CARLYLE. All right.

Now, how many institutions in this country are now recognized as being equipped to treat polio?

Dr. ANDERSON. Oh, it is treated in hundreds of hospitals. I could not say any number. I could not say as to the actual number, but we know that polio more and more is going into the general hospitals for treatment.

Mr. CARLYLE. Is the average country doctor trained now to the extent that he can tell a case of polio when he sees it?

Dr. ANDERSON. He could detect, of course, a great many of them. In the borderline cases he might want to have some help on those.

Mr. CARLYLE. Do you know about how many cases of polio are recorded in this country each year?

Dr. ANDERSON. It varies from year to year. So far this year we have had about 26,000 cases reported. I think the maximum number of cases ever reported in any one year was about 50,000. As of this time last year, and this report I have here is through the week of September 26, as of this time last year we had about 39,000 cases, and it went up to about 50,000 cases more or less. Last year was a high year.

Mr. CARLYLE. From your study of the subject, Doctor, does it appear that the epidemics that we have in this country are becoming more or less severe?

Dr. ANDERSON. My personal belief is that they are no more severe than they ever were before. We are recognizing more cases, but from the standpoint of the number of deaths resulting from the disease, using that as a criterion I cannot say that the situation is any worse than it was in years past. However, on that point some people differ with me. I would not want to state that as a general agreement as to the situatiton. That is my personal belief.

Mr. CARLYLE. I understood you to say, Doctor, that the age of a patient definitely does have some effect on the severity of the disease.

Dr. ANDERSON. The older person receives a worse infection than a younger one if he has never had it before.

Mr. PRIEST. Will you yield for a question, Mr. Carlyle?

Mr. CARLYLE. Yes; I will yield.

Mr. PRIEST. Is there any particular difference, Doctor, in the response to treatment in the different age groups?

Dr. ANDERSON. I do not think that you could say that there is any difference in the response to treatment. It may be that Dr. Ellwood would differ with me on that. An adult who get measles gets a more severe form than a child, and in the case of chickenpox we would get a more severe form in an adult.

Mr. CARLYLE. The disease is more prevalent in the case of the younger boys and girls?

Dr. ANDERSON. Yes; we get more cases in that age group.

Mr. CARLYLE. Do you think that is because a child is weaker and not able to throw off the germ?

Dr. ANDERSON. No; I think where a child has not been previously infected, previously exposed to the disease, he does not get it until he is exposed. It is the same as in measles; we catch measles if we have not had it before, and so it is with polio.

Mr. CARLYLE. Is climate a factor at all?

Dr. ANDERSON. Most of our severe outbreaks of polio have been in the temperate zones. On the other hand we have data on outbreaks in the Orient. I recall that there was a very bad outbreak in 1947 in February and March. We have seen outbreaks of polio at the Equator, but mostly it is in the temperate zones.

Mr. CARLYLE. Doctor, referring to the unknown facts about polio, if I understand you correctly, it is not known what causes it?

Dr. ANDERSON. Well, we know that it is a virus disease. We know that there are three different strains of viruses which cause it.

Mr. CARLYLE. Is it known where the virus originates?

Dr. ANDERSON. It exists in the human body. We have no evidence of its existence in any other animal.

Mr. CARLYLE. Is it generally accepted as a fact that it is not communicated through water, milk, food, or flies?

Dr. ANDERSON. I think in our country the bulk of the medical opinion is at the present time that it is fairly directly spread from person to person. Now, that does not mean that it cannot be occasionally caused the other way, but the mass phenomena of the disease seems inexplicable on the basis of a waterborne or milk spread.

Mr. CARLYLE. That view is comparatively new, is it not?

Dr. ANDERSON. No; it is old.

Mr. CARLYLE. It is?

Dr. ANDERSON. We went through an era in the thirties when we developed the idea of spread from direct contact. We got interested in milk and feces, and then we have pulled away from that and gone back to spread by personal contact.

I said that there are two different ideas as to the mode of spread of the disease from person to person. In the early thirties, the late Dr. Trask demonstrated polio virus can be found in the soil. We began to examine the possibilities of transmission by water and feces.

Then also some people talked in terms of a direct spread from hand contamination because of discharge in excreta. That is an intestinal spread, but it is not caused through the medium of milk, water, or food, but hand contamination, as somebody put it, as if we were covered with a microscopically thin film of excreta on everybody's hands which might be passed on individually simply from the hand condition.

Mr. CARLYLE. It is akin to any other disease?

Dr. ANDERSON. What do you mean by akin?

Mr. CARLYLE. I mean is it similar to any other disease that we have in this country?

Dr. ANDERSON. Yes; we have other infections that it can be confused with. We have the so-called Coxsachie virus infection, which is named after the place where the virus was first discovered. We have that which may simulate a very mild form of polio, but it does not leave residual paralysis.

We are always faced with this problem that this may not be a polio infection. There are a great many diseases it can be confused with.

Mr. CARLYLE. Now, Doctor, as to the method of the treatment of polio, does it necessitate an internal or an external treatment?

Dr. ANDERSON. It is external. We have no drug at the moment which will kill the virus in the body.

Mr. CARLYLE. In the laboratories is there any work in progress to develop anything similar to penicillin that would cure this disease?

Dr. ANDERSON. Yes; work has been done along that line, and I am perfectly confident that every new antibiotic that comes along is beyond the treatment of polio at present. I know that various projects have been directed specifically at polio. I cannot see anything that is promising yet, but it is not beyond possibility that somebody might do that.

Mr. CARLYLE. Doctor, is there any real progress being made to prevent polio?

Dr. ANDERSON. Yes, sir; I would say that there is very definitely. These efforts have been made in two directions. One you will hear about this afternoon in terms of gamma globulin. I would say it is progressing. I do not believe we have arrived, but we have also learned a lot and made a lot of gain with respect to polio vaccines, about which you will hear next Monday. They are making progress in this field.

Mr. CARLYLE. Has progress been made toward administering something to the individual before they have the symptoms of polio, like a vaccine?

Dr. ANDERSON. In the case of gamma globulin it would have to be given for protection for 4 or 5 weeks for an individual who has been exposed to the disease or was going to be exposed to it. Vaccination would be a long-term thing for later years in the event of exposure.

Mr. CARLYLE. So, Doctor, there is no medicine with which you can treat polio. About the only thing that a doctor can do after a patient is found to have it is to keep the patient comfortable and let it run its course; is that correct?

Dr. ANDERSON. No, there is a great deal being done. There is the use of respirators in certain cases and the use of exercise and heat. There is a great deal that can be done, not just in keeping them comfortable, but in terms of prevention of the development of the disease and in terms of treatment.

Mr. CARLYLE. But you use a treatment after a patient is affected with polio that is entirely external?

Dr. ANDERSON. Yes, sir; that is right. We have nothing internal in the way of medication.

Mr. CARLYLE. That is all.

Mr. KLINE. Mr. Chairman, I recognize our time is very limited. I have two more medical men here that I would like to put on briefly.

I wonder if, while continuing with the discussion as it is going on, you cannot call on Dr. Jungeblut, who is professor of bacteriology at Columbia University and who has been in many medical conferences and scientific discussions and in research projects.

The CHAIRMAN. We will be pleased to hear the doctor.

STATEMENT OF DR. CLAUS JUNGEBLUT, PROFESSOR OF BACTERIOLOGY, COLUMBIA UNIVERSITY

Dr. JUNGEBLUT. Mr. Chairman and members of the committee, it was my privilege to be one of those who testified before your committee 6 or 7 years ago, and my association with the Kenny Foundation has existed for a much longer period of time.

You may be interested to know why I turned to the Kenny Foundation as a foundation with the interest I have as a bacteriologist in laboratory problems. I found that organization was the only organization that was willing to give money to an investigator without attaching any strings. They give you enough funds and do not dictate to you nor exercise any directional influence over you. At the same time, they demand a report at the end of the year and an audit of the expense. I think it is extremely difficult to find another organization which is as liberal in general with the use of their funds.

The CHAIRMAN. A little louder, please.

Dr. JUNGEBLUT. Over this past year I have received from the Kenny Foundation somewhere around $100,000, which has been spent entirely on laboratory research, not clinical research.

The other reason for preferring to work with the Kenny Foundation was that they maintain some very well run hospitals which give me opportunity to get clinical samples. If you are interested in some samples, such as blood samples, you can get them in any shape or form you want them.

The other point, and perhaps the most important, was an intellectual reason. The medical profession seemed to think that Sister Kenny had something of value in the treatment of paralysis by local manipulation and by packs or some other methods that seem to alleviate paralysis and speed the recovery of the patient. It seemed that their basis for local paralysis in the muscles must be that such a peripheral involvement was due to an interruption between the spinal cord and muscles. In other words, a lesion on the spinal cord that was interrupting the nerve impulses to the muscles and the paralysis would be entirely centered.

Now, of course, that sort of thing can be produced traumatically. If you cut a nerve, the lower portion of that extremity is paralyzed.

I think many medical men felt that the paralysis in poliomyelitis was of that nature, because one did see the lesions in the spinal cord. And if the paralysis improved with hot packs and if there was such a thing as a spasm, it seemed to indicate that there was a local paralysis. The paralysis must be aggravated and perhaps in some way conditioned by some local disturbance.

We were interested in that particular angle, and I think perhaps we were responsible, through our work, for drawing attention to the fact that the paralytic process in poliomyelitis is both central and, as we say, peripheral. There is also a peripheral paralysis. There is muscle inflammation. The muscle fibers can definitely be shown to be involved. All that was necessary to be done was to have specimens taken out of the muscle of patients during the acute stage.

I am giving this as an illustration of how important the closeness of the connection in that type of work between the laboratory and the clinic that is willing to do this sort of thing is.

After that was done the question came up: How does the virus reach the central nervous system from those peripheral areas. Again, there was a conflict of ideas for many years. Many people seemed to think that this travel of the virus was entirely along nerve routes. Somewhere it makes contact with an exposed nerve ending, and the entire disturbance follows the ramification of the peripheral nervous system.

Well, there was enough evidence in our work to throw some doubt on this mechanism as being the all-important one except in a few exceptional cases. I think we were some of the first ones to sponsor the viewpoint that the bloodstream was one way of disseminating the virus; that there was an early invasion of the bloodstream in which the virus got into circulation and was carried with the bloodstream into remote areas of the body.

This work has since been confirmed by others, and it is the basis of this present work. The viremia, the presence of virus in the blood, has become the basis for gamma globulin work. Gamma globulin

tends to neutralize the virus circulating in the blood, and after this neutralization has taken place you cut off further invasion of the virus from the extraneural phase to the neural phase. I think that was in itself a very important finding.

So that what we have done has not been the type of work the national foundation has done. They are better equipped, and they have different perspectives to do certain types of things. It is more this fundamental type: On what cells does the virus multiply? Are they nervous or nonnervous cells? If it multiplies, what substances does it use up? After it has multiplied in certain areas, how does it spread to others?

It seems to me so much fundamental information is missing in poliomyelitis. We have been going along so empirically with our attempts to control this disease, that it was necessary to fill in at the base of the pyramid an awful lot of information before one could intelligently hope to control the disease.

I will say that I think the funds that the Kenny Foundation has given to us have made possible this type of fundamental work. Yet if an antibiotic is found, or a chemotherapeutic substance, against poliomyelitis, it will be done in a much more intelligent way now than perhaps some 4 or 5 years ago.

Four or five years ago one would have taken 1,000 compounds from all different origins and tested them without rhyme or reason to see whether one or the other would have an effect. Now we know there are screening tests. We would have suitable virus strains, test strains. We would select only compounds that we would expect interfered with virus multiplication, because we know in which way viruses mass inside of cells and in what cells they multiply. So that this type of work has nothing to do with the immediate clinical application, but I think it is difficult to imagine any intelligent control of the disease unless we have filled in more of these fundamental facts.

Mr. DOLLIVER. Are there any questions, gentlemen?

I would like to ask a question, Doctor. As I understood you, the support has been given you by the Sister Kenny Foundation and has been used principally for research.

Dr. JUNGEBLUT. Yes, entirely.

Mr. DOLLIVER. Have your researches had to do with inflicting this disease upon lower animals?

Dr. JUNGEBLUT. It had to do also with another problem. As Dr. Anderson said, there are different strains of poliomyelitis. Perhaps the field is even wider. Perhaps there are different forms of poliomyelitis that are different viruses that fall into a family with a rather wide spectrum.

It could be that observations made in one epidemic, that seem to indicate that there is no reservoir of the virus, are not applicable to another one where there is one. We have examples of that in many other diseases.

We have different forms of typhus fever, the basic form of the human infection. In one case it is a louse and in the next case it is a flea. In another case we have an epidemic disease, and another one an endemic one, according to the location of where this occurs.

It seems to me it would be good to have an open mind about the possibility that different forms of paralytic involvement that look clinically like poliomyelitis occur in different parts of the world under different conditions and are due to different strains of it. For that

reason we have studied a good many different strains. We have studied strains that have been isolated from different parts of the world, from the tropics, this country and Mexico. Some of these strains infect monkeys; others infect mice; and others, rodents.

Some of our work has been directed in those channels, to see what we could get by comparison.

Mr. DOLLIVER. What is the highest form of life you have used experimentally?

Dr. JUNGEBLUT. The chimpanzees. That is all right except that they are so expensive that you cannot run any mass experiment on them. I think they are practically valueless, because the experimental work depends on a series. You do not get anything with one throw. You have to have 10 or 20 animals in an experiment to draw conclusions.

Mr. DOLLIVER. Any other questions? Mr. Priest?

Mr. PRIEST. Mr. Chairman, I will ask 1 or 2 questions.

Doctor, I understood you to say that as a result of your research you had definitely determined the type of cell on which the virus multiplies or increases itself; is that correct?

Dr. JUNGEBLUT. We have at least done this: We have done away with the notion that the virus will multiply only on nerve cells.

Mr. PRIEST. Only on nerve cells.

Dr. JUNGEBLUT. It was thought for a long time that the virus will get to the center of the system and find the nerve cells and grow in these nerve cells, and that that was the location. I think that is wrong. I think it has been generally accepted that the virus grows outside of the nervous system and cells, in cells that have nothing to do with nerve cells. The excess spills over to paralysis. A purely accidental terminal phase of the infection is achieved which is much more widespread than anyone thought before.

Mr. PRIEST. It seems to me, as a layman, that that is a rather important discovery in research.

Dr. JUNGEBLUT. I would think it is the most important one, because if someone tries to cure polymyelitis by chemical substances it would be absolutely hopeless to protect the nerve cell against the onslaught of the virus, but it seems feasible to protect the body against a multiplication of the virus in the intestinal tract or the bloodstream, and stop the multiplication there, and in that way prevent further central nervous system involvement.

Mr. PRIEST. Doctor, in your research is it your conclusion that this finding will apply to all three types of virus? I believe there are three general types.

Dr. JUNGEBLUT. I think that question is a very complex one. I have just come back from the international meeting in Rome, where this had been discussed at great length. The feeling seems to grow among people in that field that what we call one virus strain is not really one population. It consists of different kinds of particles. You know that only inbred forms produce duplication of the same form. In all living forms you have mixtures of certain genes, and it looks like a uniform strain but in reality it is a mixture and we have different genetic components.

I think we feel now that perhaps poliomyelitis is such mixed populations. In them lies the possibility to produce all sorts of variants that can come from this mixed population.

For instance, work has been done now in treating different media and they have come out with amazingly divergent properties from what seem to have been the pure culture of one strain.

Mr. PRIEST. That is all for the time being, Mr. Chairman. Thank you, Doctor.

Mr. DOLLIVER. Any other questions?

Mr. KLINE. Well, gentlemen, if you will bear with me for a few minutes, I do not know how much time you want to give us, but I have one more doctor I would like to call upon.

Mr. DOLLIVER. Will you please do so.

Mr. KLINE. One of the problems we have, getting back to the operation of our polio hospital, is early diagnosis and immediate care of the patients; but each year we get some residual tough cases that hang over into the next season. Dr. Elwood is running the inpatient phase of the Kenny Institute and for the second year has more and more been presented with this problem. I think he has come up with some good thinking.

I would like to introduce Dr. Elwood at this time to explain his position and viewpoint.

STATEMENT OF DR. PAUL ELWOOD, DIRECTOR, INPATIENT SERVICE, SISTER ELIZABETH KENNY FOUNDATION

Dr. ELWOOD. I do not know whether you want me to mention anything about what the disease is like, such as you were talking about, Mr. Carlyle.

Mr. DOLLIVER. I think we would be interested in hearing that, Doctor.

Dr. ELWOOD. I can tell you the story we get when a patient arrives at the hospital. They will usually tell of having had a slight fever, a sore throat, and maybe a little loss of appetite for maybe 1 or 2 days. Now, maybe 3 or 4 members of the same family will give this same story. They all had it. Then they feel pretty well for a couple of days, and then maybe just one member of the family will go on to develop a headache, difficulty in sleeping, listlessness, and a stiff neck and back.

When you try to put their chins down on their chests, it goes down about this far [indicating] and that is as far as you can move it. The same thing applies to the legs. As you try to bend them up on the abdomen they get tight and they complain of pain along the back of the legs.

This is what we call the nonparalytic poliomyelitis, if it goes just this far. There is evidence of invasion of the virus into the central nervous system, in that they have these headaches, and so forth, but there is no evidence of a muscular weakness. They can move everything. If you ask them to flex an arm they do it fairly well. They walk with a fairly normal gait.

From this point the disease can go on to several different types of polio. One is what we call the spinal paralytic type, in which there is an invasion of the virus to the part of the spinal cord that sends messages out to muscles to move. These people will say: "My arm feels kind of funny. I think I can move it but when I try it does not move."

They have complete presence of sensation in their arms or legs or whatever the affected part of the body is, but it just does not work

right. This occurs in all degrees. You will ask them to move their arms up, like this [indicating], and with a normal arm you can apply most of your force to it and it will not move down, but with somebody with polio, if they have any weakness in an arm, you can apply just a mild amount of force and the arm will move down. In some cases they cannot even move it up.

Then another phase of spinal paralytic polio is when the muscles of respiration are involved. The diaphragm and intercostal muscles do most of our breathing for us. If the part of the spinal cord which sends out messages to those muscles to move is affected, the patient is unable to breathe. If you press on the abdomen of the patient and ask him to take a deep breath he cannot do it. If you ask him to cough he cannot move enough air to cough. This, too, occurs in all different grades. There are some where there is just a slight reduction in their ability to breathe, and others where the ability to breathe is so impaired that they absolutely have to go into a respirator or they could not live.

Then the next type of disease that the public is so afraid of is bulbar polio. Right at the base of the brain there is the part of the brain called the bulb. This is actually polio of the lower brain. In this area there are various nerve centers, some of them going to the throat that allow for swallowing, and others that go to the muscles of the face. A patient may not be able to move his face on one side. It may be the jaw. Maybe he cannot open his mouth, or the tongue may deviate to one side. It even may affect the eye muscles, so that he cannot look from side to side.

Even more serious, there are a couple of centers in the brain which control respiration and circulation on a higher plane than just muscles. These patients can breathe all right. If you stimulate them to take a deep breath they have the muscles to take a deep breath, but the impulses that tell them to continue to breathe automatically are lost. Therefore, they will breathe along very rapidly and then maybe breathe very slowly. This is, in our opinion, the source of much of the fatality in polio; this involvement of the center which regulates blood pressure and the heart.

If the cardiovascular center, as we call it, the one that regulates the blood vessels and the heart, is affected, there is in most cases very little we can do. You can breathe for a patient and you can provide him with an adequate air way, but if his heart stops beating there is very little in the way of treatment that we have to offer. Just in the last year or so there have been a couple of new drugs which are very satisfactory for raising blood pressure, and I think these drugs in part are the reason why our mortality rate from polio is going down some more.

Mr. DOLLIVER. Where is this center for the heart actually located?

Dr. ELWOOD. It is in the medulla or the bulbar portion of the brain.

Mr. DOLLIVER. The lower portion?

Dr. ELWOOD. Yes. In fact, it is right next to the place that regulates swallowing. That is by far the most common bulbar center involved. The facial is the most common. Most of these patients just say they cannot swallow, and they cannot even swallow their saliva; they have to spit it out.

Then the other type of polio is what we call polio encephalitis, which is a sort of polio sleeping sickness. It gets all the way up to the top of the brain and the patient is very lethargic and does not

respond much. Amazingly enough, these patients do pretty well, I think. They are very sleepy and sometimes disoriented for a day or two, but seem to snap out of it.

Then we move on to diagnosis. The diagnosis of polio is not an easy one, particularly in the nonparalytic or peculiar case, for instance, of polio encephalitis, because there are a lot of diseases that imitate it and give similar symptoms.

The average doctor in his practice does not have an opportunity to see much polio. If you figure a huge epidemic is a couple of cases per thousand population, a doctor working in a town with a practice of 3,000 or 4,000 people, would only see 6 cases of polio a year in the epidemic years. So, therefore, a center where people who are working with hundreds of cases of polio, who know what the ramifications of the disease are, is pretty essential to very accurate diagnosis, I think.

Our experience has been that this year we have treated 600 acute cases of polio since the 1st of July at the Kenny Institute. Out of these 600, we had 150 additional cases that were sent to us as probable polio which, in our opinion, were not polio. But that really is not bad as a level of diagnostic acumen in any disease, I think.

When they come to us it is a peculiar disease in that this acute part of the thing that you were talking about, Mr. Carlyle, is involved. Once they develop the central nervous system symptoms—the headache, and so forth—that is when we see them. Then the whole disease only lasts about 5 days from the beginning of the fever until the end.

It is true that we pretty much have to sit around with our fingers crossed until that 5 days is gone. We can use a respirator and can do a tracheotomy—opening a hole in the windpipe to allow them to breathe—but if they have no good resistance to the disease it will progress on to the point where we cannot do very much about it.

But the majority of cases are very mild. Probably 70 percent of the cases we admit to the hospital go home with no paralysis whatsoever. The rest of them will have mild degrees of paralysis.

Mr. DOLLIVER. Do you attribute the happy part of that result to treatment or to the inevitable course of the disease?

Dr. ELWOOD. I think to the inevitable course of the disease. Sister Kenny—and nobody else—does not claim to be able to make nerve cells that are dead come back to life. What she does claim is that what nerve cells are left and what muscles are left the patient should be able to get the maximum amount of benefit from. Her methods have been found to provide that quite satisfactorily.

But out of this group that we are saving now, the mortality rate from polio over the last 10 or 15 years has ended up about 5 to 10 percent—that is, 5 or 10 out of 100 died from the disease.

This year now we are down to about 2 percent of the cases that come down with polio and are admitted to the hospital who die from the disease. Therefore, we have this from 3 to 7 people whom we have saved, but they are very seriously involved.

This year, out of our 600 admissions, we have about 25 patients in respirators and, in addition to that, there are 15 or 20 more that have pretty much paralysis of all 4 extremities. In other words, they can move practically nothing effectively.

Each year this piles up. Now, in 1950, we admitted 350 patients to the Kenny Institute. A year later what we had left over was 34 seriously paralyzed people who needed hospitalization of more than a year's duration and some of them for life.

The following year we admitted 420 patients and by June, when we were ready to start taking acute cases again, we had 50 left in the hospital.

This year we had a huge epidemic. We took care of 1,300 cases—I mean last year. That is out of about 50,000 cases in the whole United States, so that approximately 1 out of every 50 cases of polio in the United States was treated in this 1 hospital. Out of that we had left about 110 people who could not go home from the hospital.

This year we will add to that number by 25 or so, so that we will have 125.

Well, with polio being a mild disease, as it is in the majority of cases, each bed you take up permanently with a patient actually eliminates about 6 patients you can treat, because in an epidemic period our 250-bed hospital can treat 1,200 patients, because they come in and stay an average of 18 days and then go home. But if these more and more serious cases accumulate, the number of beds that any one hospital has available for the treatment of the milder cases of polio is reduced.

The respirator care requires the most intensive of nursing and medical care. The patient is helpless within this box. He cannot move his arms or legs. He cannot turn himself from side to side. He cannot take care of his bodily needs. Somebody has to feed him. Therefore, it takes tremendous numbers of personnel. It takes mechanics to keep the respirators going.

These people are very completely dependent upon this machine continuing to work 24 hours a day. Just the maintenance of the 73 pieces of the respirator equipment which we have is a tremendous problem.

Then we get down to the patient himself. As you can imagine, these patients have tremendous psychological problems. The majority of the patients we have in respirators are adults. I think of the 25 we put in this year only 4 are under the age of 15. Therefore, they are the mothers of the families, or the breadwinners, and the problem of having to live in a hospital for the rest of your life, depending upon a machine, is a real tragic one.

Yet this disease is not like many of the diseases that have been considered here—heart disease and cancer—which are pretty much progressive sorts of diseases. This disease runs its 5-day course, and that is the end. What you have left is an individual who cannot move, but who has complete control of his sensations. He can hear. He can talk. He can think just as well as he ever could. But he has no means of earning a livelihood, according to our current concepts of rehabilitation.

It is my feeling, after walking around and seeing what these people are like, that a real effort needs to be put forth on the part of everybody who is treating polio to take care of what the disease has left behind; to do everything we can to rehabilitate these people mentally, and if possible, economically. I think it is a rather artificial approach to attempt to keep them in a hospital forever, living in sort of an atmosphere away from their families. They become progressively depressed.

I think there are things that these people can do, but it is going to take a lot of inventive genius to develop devices that they can use to read with, to dictate with, and to talk over the telephone with. There

are things that will make it possible for them to carry on a business of some kind which can be developed.

We have had some interesting examples of that in Minneapolis. We have a man there who is an engineer for the Minneapolis-Honeywell Corp., a very brilliant young fellow, who is completely paralyzed, but he is able to get out into a chest respirator and therefore can sit up in a chair and is pretty free of the great big tank that covers his whole body. The Minneapolis-Honeywell Corp. has taken quite an interest in this man. A couple of their engineers went around and saw the existing device for turning pages for patients like this. The Veterans' Administration has developed some. Just a couple of these buddies of this fellow sat down and designed a device for turning the pages, so all this fellow has to do is move his chin like that [indicating] and this arm comes down and picks up the page. It picks up one at a time, or if it takes two together, it will put the other one back.

That is a very good example of how the whole community working together on this problem can cope with it.

My feeling is that Minneapolis just happened to be very fortunate in having an institution of this sort that not only treats the acute stage of the disease and saves lives but is interested in the long-term aspect of this thing; because whether we get a vaccine tomorrow or 5 years from now we have what the disease has left behind. The expense and the psychological trauma to these individuals is tremendous and a real community problem.

Mr. CARLYLE. One question, Mr. Chairman.

The CHAIRMAN. Mr. Carlyle.

Mr. CARLYLE. Doctor, you have referred to the scarcity of trained nurses. Of course, that is true all over the country. I would think it is true in every hospital in the country.

In the event that an ambitious trained nurse should decide that she was anxious to become trained in treating cases of polio—of course, cooperating with a physician—how would she go about obtaining that necessary training?

Dr. ELWOOD. Well, I think the only thing for her to do is to go to an institution where they are actively treating it and more or less serve an apprenticeship right on the wards doing the job.

Mr. CARLYLE. You mean in some local hospital?

Dr. ELWOOD. Well, whatever hospital they might have that happens to be treating it.

Mr. CARLYLE. There is no institution there set up for the purpose of training these nurses?

Dr. ELWOOD. Well, that is what we do, actually. We take nurses.

Mr. CARLYLE. That was what I thought. How would that nurse proceed to do this? Would she just apply for admission to enter that school?

Dr. ELWOOD. I think all she does is apply to the Kenny Foundation in Minneapolis. I understand they do not just accept anybody.

Mr. KLINE. We have certain standards, of course.

Mr. CARLYLE. Is there a tuition?

Mr. KLINE. May I just take over for a second?

We have a pamphlet that we will distribute for you gentlemen later that explains this.

We accept registered nurses and registered physical therapists for the course, and we have certain standards. For that up until this last

year we have provided $240 a month scholarship for them. We take care of all the other costs. That, of course, is for the nurse or physical therapist's living, you might say, and things of that type.

This next year we are going to make that $275 a month. That has been necessary because a lot of these women and especially the girls who get out of school are thinking of marriage and other things. They can command a salary anywhere from $200 to $300 a month in their own communities.

Mr. CARLYLE. It is more than that.

Mr. KLINE. And more in different places. A lot of them hesitate to take 2 more years of training.

But the Kenny Foundation is always open for providing scholarships for nurses or physical therapists to become specialists in polio.

Mr. CARLYLE. That is all, Mr. Chairman.

Mr. DOLLIVER. Mr. Chairman?

The CHAIRMAN. Mr. Dolliver.

Mr. DOLLIVER. I do not know to whom this question should be directed, but welcome anyone who can answer.

Do the medical schools have a regular systematic course of teaching about this disease? To phrase it another way: How many hours of polio teaching does an average medical student get in a medical school?

Dr. ANDERSON. That would vary considerably from school to school. In the case of polio we would usually find it would be present in a great many different courses.

In the department of bacteriology they would be discussing the virus. In pathology they would be discussing the effects of the disease. In clinical medicine they might be discussing it, and also in the department of pediatrics and preventive medicine.

As the student gets into his clinical year, depending upon the breaks of the game that year he is there, whether there is a lot of polio or a little, he might see quite a lot or he might see very little. I would not be able to give you a figure in terms that would be necessarily an average. I would not want to necessarily give you a figure for the University of Minnesota, other than I think aside from his clinical picture he has probably picked this up in bacteriology and pathology and in his course in public health. He has probably picked up 12 or 15 hours, or maybe 20 hours on the basic science kind of knowledge of polio. When he gets into his clinical years he may see a lot of polio or he may see a little. I do not know how we could figure it in terms of actual hours.

Mr. DOLLIVER. Thank you very much, Doctor.

The CHAIRMAN. How are the patients selected who receive the treatment at your Minneapolis Hospital?

Mr. KLINE. We have a policy that any polio patient who is diagnosed as having polio by a doctor and referred to a Kenny Institute will be accepted. Of course, we have to qualify that briefly by saying that is true as long as a bed is available.

But in epidemics, let us say, in Minneapolis, which is typical of our operations, we will find our hospitals full, as we did last year and in 1946 and in 1949 and this year, and with our trained staff we provide facilities in other hospitals. At the present time in Minneapolis we have trained personnel in three other hospitals taking care of the overflow of patients. In other words, we take them in the acute stage at the Kenny Institute. Some of those will probably be discharged in the matter of 1 week, 2 weeks or a month, and then transferred over

to another hospital before going home, but they continue to get the Kenny treatment until discharged.

The CHAIRMAN. Is there a fixed charge?

Mr. KLINE. Our charge is, I suppose, figured basically the same as that of most hospitals. We change our setup each 6 months in compliance with the organization in the Minneapolis area. Some of our hospitals change from year to year.

The last 6 months our charge up to the first of the month was $12.50 per day. The present going rate now is $16 per day, which includes, of course, everything, including the Kenny treatment.

The CHAIRMAN. Do you have a good many applications from places other than Minneapolis or Minnesota?

Mr. KLINE. In the institute that is located at Minneapolis, which is our teaching and training center, as well as treatment, we take patients basically from the 5-State area, although at times we have therapists up at Duluth or DesMoines, Iowa, as we have had the last few years and still have this year. We try to route the people. For instance, if we get inquiries from the East it would be to the Jersey City Medical Center or to Buffalo, N. Y., or to Michigan. On the west coast it would be to Los Angeles or San Francisco or a nearer place.

The CHAIRMAN. If a child in New Jersey were taken down with it, would he get the same treatment at the Jersey City Medical Center that he would get at your hospital in Minneapolis?

Mr. KLINE. Yes, sir. They have a fully competent staff to administer the Kenny treatment.

Mr. HESELTON. Mr. Chairman.

The CHAIRMAN. Mr. Heselton.

Mr. HESELTON. Mr. Kline, as I recall it in 1947 there was a film developed in Spanish, French, German, Russian, and Greek, as well as English. Are those films still being circulated and used?

Mr. KLINE. Yes, they are.

Mr. HESELTON. Are they used extensively?

Mr. KLINE. We use that particular film, which was the so-called Documentary Film that the Sister made, with medical groups.

Mr. HESELTON. Yes.

Mr. KLINE. We have several other films that we use with lay people; some that we have made since that time.

Mr. HESELTON. With the medical groups I take it the purpose is to demonstrate to the medical people the soundness of the treatment?

Mr. KLINE. That is correct.

Mr. HESELTON. Is that asked for and used quite extensively?

Mr. KLINE. In varying degrees. It depends somewhat. We, in the years past, I think, through this film and others have created an interest—and probably the controversy created so much interest—and we are continually having doctors come in to visit from a day to months to learn more about the Kenny work. Some of these doctors, in turn, then request the film, or various films, which, of course, we are very happy to provide. They are taken back to Texas, or wherever they happen to be from, and they, in turn, show them and then send them back. Those are always available.

Mr. HESELTON. That is all. Thank you.

The CHAIRMAN. Having in mind the testimony of Dr. Anderson that this disease could be communicated from person to person, does

that create the necessity for having hospitals especially adapted for polio, or can it be treated in a general hospital? I was prompted to ask the question because of what you said, Mr. Kline: That you utilized in times of stress and strain three other hospitals in Minneapolis.

Mr. KLINE. Those patients then are out of the acute or what you would call contagious period. They are in a convalescent stage. I think Dr. Anderson referred to this: In the early stage of the disease this possibly can be transferred from person to person. I do not think he inferred that later on there was any problem. It is in the real early stage.

Dr. ANDERSON. Sir, our evidence indicates that the communicability is not at the late stage. We do know we can put such patients in a general hospital. We have to use precautions.

The CHAIRMAN. In our city of Camden, N. J., we have a special hospital for polio, separate and distinct from any other hospitals in the city. It is conducted by the municipality. Its doors are open to those who come from other localities in south Jersey. It would seem as if it were based on this being a communicable disease.

Dr. ANDERSON. In the past we have used a great deal more than we do today separate hospitals for communicable diseases. We would have an isolation hospital entirely separate from the regular hospitals.

The trend in hospitalization of recent years has been to bring our contagious units in as a part of a general hospital. Sometimes where we actually have been lacking such units in the hospital we have been able to take the cases into a general hospital.

For example, at the University Hospital we do not have a separate contagious unit. We put our patients with polio in the hospital. It may be a separate room under isolation precautions. If we have any number of them we will group them together for efficiency in handling; not so much from the standpoint of danger of spread to other patients.

We just are not ever going to have enough hospitals or enough isolation units to put everybody into a separate hospital. We find it much more efficient to bring them into our general hospitals. When we have a group, such as you referred to, such as we have at the Kenny Institute, we can with the same quantity of personnel—and, as stated, personnel is limited—treat more patients with that personnel by grouping all of the cases together.

The same is true in the University Hospital. If we get enough we put them all in one ward with nothing but polio in that one ward. It is not a question of the fear of spread of the disease to other people. We can control that through hospital procedures. We do it simply because of efficiency.

The CHAIRMAN. As a result of your experience, gained through active interest in this matter over a period of years, would you be in a position to say how much is being spent by agencies for research into the cause and cure of polio?

Dr. ANDERSON. I would say it goes into millions of dollars. I do not know the exact figure, but it is up in the millions.

The CHAIRMAN. Have you any idea of what is being spent this year from all sources? I realize I am asking you a good bit in that question. I thought it might have come to your attention from some source.

Dr. ANDERSON. I have not seen any figures brought together of that sort.

The CHAIRMAN. Would you say that there is a real serious research effort going on at the present time?

Dr. ANDERSON. Oh, very definitely. Very definitely.

The CHAIRMAN. When did that start; I mean, as serious research?

Dr. ANDERSON. Well, it has been growing more and more for years. It got a great impetus with the establishment of the foundations. Up to that time a great deal of research had been done. It goes back to the early word in the discovery of the etiology and cause of polio, back in 1912. There was mentioned the Harvard Polio Commission. This went on year after year. Every year it has been getting bigger and bigger. I think one could probably find that in 1953 more money was spent than in 1952 on research. The biggest single impetus was the National Foundation's large sum of money they turned over toward research.

The CHAIRMAN. Mr. Heselton has called to my attention some figures that appear in our previous report of hearings on page 213. We may make those a part of these hearings after we have had an opportunity to examine them.

(The information is as follows:)

SCHEDULE III.—*Statement of grants and appropriations authorized for research, education, and medical care (exclusive of advances to chapters), by years, 1939 to May 31, 1947*

Fiscal year	Total authorized	Refunds and cancellations	Net authorized	Amount per polio case reported	Amount per polio death [1]
1939	$463,972.67		$463,972.67	$63.19	$600.22
1940	709,471.86	$17,604.07	691,867.79	70.41	674.34
1941	805,562.10	24,926.28	780,635.82	85.91	967.33
1942	1,142,009.35	50,494.60	1,091,514.75	270.65	1,945.66
1943	1,244,666.24	80,544.69	1,164,121.55	93.50	1,011.40
1944	1,773,090.32	268,737.61	1,504,352.71	79.06	1,105.33
1945	2,762,989.38	52,452.66	2,710,536.72	199.03	2,285.44
1946	5,843,100.37	142,386.45	5,700,713.92	226.30	3,111.74
1947	3,336,264.06	915,594.01	2,420,670.05	225.51	3,362.04
Total	18,081,126.35	1,552,740.37	16,528,385.98	148.49	1,755.16

[1] 93 out of 100 polio patients live. Our greatest expense is their care. Mortality statistics, financially, have little relevancy in the fight against infantile paralysis.

SCHEDULE IIIA.—*Statement of grants and appropriations authorized for research, education, and medical care, 1938 to May 31, 1947 (less refunds and cancellations), by States and institutions*

State and institution:	*Amount*
Alabama: Tuskegee Institute	$1,152,134.72
California:	
University of California	380,877.13
University of Southern California	196,339.08
Stanford University	371,535.80
Los Angeles Orthopaedic Foundation	14,236.66
California Institute of Technology	300,000.00
Children's Hospital, Los Angeles	27,683.75
Total, California	1,290,672.42
Colorado: University of Colorado	14,890.37

SCHEDULE IIIA.—*Statement of grants and appropriations authorized for research, education, and medical care, 1938 to May 31, 1947 (less refunds and cancellations), by States and institutions*—Continued

State and institution—Continued	Amount
Connecticut:	
Yale University	$395,404.38
New Haven Hospital	526.00
Total, Connecticut	395,566.38
District of Columbia: United States Public Health Service	72,568.70
Georgia:	
Emory University	167,100.00
Georgia Warm Springs Foundation	1,693,819.43
Total, Georgia	1,860,919.43
Illinois:	
University of Chicago	101,462.08
Michael Reese Research Foundation	74,632.95
St. John's Hospital, Springfield	190.01
Northwestern University	244,600.24
Illinois Committee on Infantile Paralysis	23,812.10
Chicago Board of Health	15,000.00
University of Illinois	3,500.00
Total, Illinois	463,197.38
Indiana: James Whitcomb Riley Hospital	5,998.00
Iowa: State University of Iowa	73,849.89
Kansas: University of Kansas	9,000.00
Louisiana: Louisiana State University	157.41
Maryland:	
Johns Hopkins University	800,838.11
Children's Hospital School, Baltimore	5,692.81
Total, Maryland	806,530.92
Massachusetts:	
Harvard University	245,337.23
Harvard Infantile Paralysis Commission	36,000.00
Massachusetts General Hospital	79,206.64
The Children's Hospital, Boston	182,135.66
Boston University	12,500.00
Boston City Hospital	881.10
Total, Massachusetts	556,060.63
Michigan:	
University of Michigan	483,580.82
Michigan Department of Health	116,392.21
Wayne University	29,382.05
City of Detroit Department of Health	1,500.00
Total, Michigan	630,855.08
Minnesota: University of Minnesota	749,107.95
Missouri:	
St. Louis University	2,722.73
Washington University	41,116.80
Total, Missouri	43,839.53
University of Nebraska	11,980.00

SCHEDULE IIIA.—*Statement of grants and appropriations authorized for research, education, and medical care, 1938 to May 31, 1947 (less refunds and cancellations), by States and institutions*—Continued

State and institution—Continued	*Amount*
New York:	
Long Island College of Medicine	$16,271.34
Grasslands Hospital, Valhalla	6,365.83
Edward J. Meyer Memorial Hospital	3,750.00
New York University	177,459.51
Jewish Hospital of Brooklyn	4,346.34
Columbia University	85,980.87
Hospital for Joint Diseases, New York City	27,493.03
Russell Sage Institute of Pathology	6,290.45
The Society of the New York Hospital	3,630.14
New York Orthopaedic Dispensary and Hospital	3,234.79
University of Rochester	377,512.20
Cornell University	33,026.76
New York Medical College	500.00
Knickerbocker Hospital	100,000.00
New York Botanical Garden	225,000.00
New York State Department of Health	14,134.41
Hospital for Special Surgery	8,953.18
Total, New York	1,093,948.85
North Carolina:	
Wake Forest College	23,125.00
Duke University	248,205.67
North Carolina College for Negroes	8,800.00
Total, North Carolina	280,130.67
Ohio:	
Ohio State University	$6,108.50
Western Reserve University	157,641.06
University of Cincinnati	29,956.27
Cleveland Rehabilitation Center	24,923.28
The Jewish Hospital, Cincinnati	5,000.00
Total, Ohio	223,629.11
Oklahoma: University of Oklahoma	5,035.67
Pennsylvania:	
University of Pennsylvania	294,032.72
University of Pittsburgh	84,620.00
Pennsylvania State College	3,000.00
D. T. Watson School of Physiotherapy	28,200.00
Children's Hospital of Philadelphia	25,000.00
Total, Pennsylvania	434,852.72
South Carolina:	
Shriners' Hospital for Crippled Children and Greenville General Hospital	1,210.20
Medical College of South Carolina	950.00
Total, South Carolina	2,160.20
Tennessee:	
Nashville School of Social Work	10,000.00
Vanderbilt University	5,559.63
University of Tennessee	19,368.50
Meharry Medical College	67,670.00
Total, Tennessee	102,598.13

SCHEDULE IIIA.—*Statement of grants and appropriations authorized for research, education, and medical care, 1938 to May 31, 1947 (less refunds and cancellations), by States and institutions*—Continued

State and institution—Continued	Amount
Texas:	
Southwestern Medical College	$15,816.17
Crippled Children's Hospital, Marlin	2,736.05
Texas Scottish Rite Hospital for Crippled Children	10,750.00
University of Texas	53,545.00
Total, Texas	82,847.22
Utah: University of Utah	24,859.81
Virginia: Medical College of Virginia	2,997.00
Washington: University of Washington	7,700.00
West Virginia: Morris Memorial Hospital	2,000.00
Wisconsin:	
University of Wisconsin	148,537.40
Marquette University	19,500.00
Total, Wisconsin	168,037.40
Foreign:	
University of Toronto	41,242.12
Children's Hospital of Winnipeg	1,080.00
Catholic University of Chile	500.00
Total, foreign	42,822.12
National organizations:	
American Orthopaedic Association	1,815.46
American Academy of Pediatrics	116,000.00
American Hospital Association	55,000.00
United States Public Health Service	395,836.89
National Organization for Public Health Nursing	271,490.21
National Research Council	370,000.00
American Physiotherapy Association	126,280.76
American Association of Medical Social Workers	201,760.00
American Public Health Association	35,350.00
American College of Hospital Administrators	50,000.00
American Association of Medical Record Librarians	156,800.00
National League for Nursing Education	131,183.34
Provident Medical Associates	50,000.00
Total, national organizations	1,961,516.66
Administered by the National Foundation for scholarships, fellowships, publications, etc	3,955,920.71
Grand total	16,528,385.98

The CHAIRMAN. Are there any further questions, gentlemen?

Mr. CARLYLE. Mr. Chairman?

The CHAIRMAN. Mr. Carlyle.

Mr. CARLYLE. I am frankly disappointed and discouraged to learn that polio is caused by a germ invasion and that the spread of this germ throughout the body is to an extent that it is almost completely disabling, and yet we have no medicine of any kind that has for its purpose the combating or destroying of the germs that have infected the body. That is the case, is it not, Doctor?

Dr. ELWOOD. Well, Dr. Jungeblut is much more qualified to answer this than I am, but I can tell you briefly that I am sure the National Foundation will go into this when they come here. There have been a couple of new drugs which have come out in the last 2 or 3 years that

are somewhat promising. None of them have been used on human beings, but at least we can say that these drugs protect tissue cultures which we used to grow the virus in, against polio.

There is some evidence that some day an agent may be discovered that will actually protect an individual against this disease.

Mr. CARLYLE. That is hoped for, Doctor. But it is a fact, or it seems to be, that this is a disease in which when a person becomes affected it is necessary just to let the disease run its course without internal treatments; is that not correct?

Dr. ELWOOD. No. This applies to almost every virus disease.

Mr. CARLYLE. Does it?

Dr. ELWOOD. All of the virus encephalitides, or the sleeping sicknesses, and so forth, are not treatable with any antibiotic agent. Good supportive care has made a tremendous difference so far as the death rate from this disease is concerned. Whether we have an agent to actually kill the virus or not, taking good care of the patient while he goes through this period has definitely influenced the death rate.

Mr. CARLYLE. Polio is one of our oldest diseases; is that correct?

Dr. ELWOOD. Well, in about the same period that was described we have polio. That was the real start of modern medicine. Almost all diseases were described during that period, the infectious diseases.

Mr. CARLYLE. We really, though, have not made very much progress in the way of combating it, have we?

Dr. ELWOOD. Well, let us say we do not have a specific agent to combat it. So far as the virus diseases are concerned, the whole group of them, there is not any agent that works.

Mr. CARLYLE. I know, Doctor, it is a tremendous problem. There is no question about it.

Thank you, Mr. Chairman.

The CHAIRMAN. In conclusion, would any of the panel members wish to indicate to the committee what you think should be the program or course of congressional interest in this subject? Would you state whether it is a State matter or a local matter or a combination; or whether there is a field of activity for public action; or whether it should be more or less a private field, as is now the case?

Mr. KLINE. Well, I think that, first of all, all of us feel that this committee is doing a tremendous service in taking the time that you are to make the study of all of these fields you are discussing.

As I mentioned earlier, from our standpoint—I think all of us—one of the crying needs in this country and throughout the world is for more trained personnel. Somebody—I do not know who—has got to do something about it.

I think that in the field of polio, with the Kenny Foundation's program, in a sense we are moving as rapidly as we can. We would like to move faster. We are concerned, as Sister used to be, but it just takes time. I think so far as research is concerned a lot of funds are made available. Probably it is necessary to make more funds available.

I really do not know what we can say as an organization as to what we think you people should do, but we do feel that you are making a step in the right direction in seeking this information from all groups in the fields of polio and other diseases; and, as you indicated in your telegram, there is a possibility of coordination and collaboration. We all recognize that there is a tremendous economic loss in

having these diseases unsolved; and right today, just in the field of polio, there are undoubtedly many, many children and people who are unnecessarily deformed because they do not receive early care and treatment.

So far as any recommendation that I can think of is concerned, I do not have any other than that I think you are on the right track. We certainly appreciate having the opportunity to answer any questions and present the small part that we are doing in the field of polio; and it is our feeling that it is going to be necessary, regardless of the research for probably a number of years, to continue this work.

The CHAIRMAN. We appreciate the attendance of you folks here today. You have given of your time and effort to come here. It has been very helpful to us as a committee in our search for knowledge and a solution of these problems, of which this is one that comes very close to our hearts, because it so frequently touches the children. We feel that you have performed a very important service and made a very great contribution to the work of this committee by your attendance here today.

The appearance of Sister Kenny before this committee some years ago lingers with us even yet in a very pleasant memory. We were impressed greatly by her forcefulness.

Recognizing, as you have indicated, that at times she may have seemed impetuous, it was due to the fact that she had a very great desire to do good and felt that she had the means by which it could be accomplished if it would only be recognized. It may have seemed at times she was impatient because others did not recognize the value of it to the extent that she did herself, all of which is commendable, because the purpose is to bring about health to those who are in need.

You folks have carried on and are carrying on and I trust you will carry on in the spirit that dominated her in the work that she did. I would like you to know that we do appreciate your attendance. We feel very grateful to you. We also want you to know that if there is any additional information that you would like to make a part of this record we will be pleased to have you submit it to us.

You have already referred to a pamphlet, which I assume would be appropriate to be made a part of your appearance before this committee. We also want you to feel that any other prepared material that you have that could properly be made a part of this committee record you are perfectly free to submit to us, because we would like your appearance to be supplemented with whatever information you have that will prove helpful.

(The information is as follows:)

[From Postgraduate Medicine, February 1950]

DIAGNOSIS AND TREATMENT OF INFANTILE PARALYSIS

By Edgar J. Huenekens,[1] University of Minnesota Medical School, Minneapolis

This paper has not been planned to cover all aspects of the diagnosis and treatment of poliomyelitis but rather to select a few important practical points. Under diagnosis, I propose to emphasize the difficulties from the viewpoint of the physician who first sees the patient, usually the family physician or pediatrician. Under treatment, I will confine my efforts to a discussion of the highly specialized type of physical therapy known as the Kenny treatment.

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Presented October 31, 1949, before the meeting of the Interstate Postgraduate Medical Association of North America, Philadelphia, Pa.

DIAGNOSIS

Because we have no specific test to verify the presence of poliomyelitis, the diagosis may be very difficult, especially in the early stages. The first symptoms are usually one or more of the following: Fever, malaise, headache, nausea, and vomiting. Except in unusually severe cases, there is no stiffness of the neck and back and no muscular pain. A positive diagnosis cannot be made at this time, since all these symptoms are compatible with a nonspecific upper respiratory infection.

When confronted with such a situation during a polio epidemic period it behooves the physician to warn the parents that although there is no definite evidence of poliomyelitis, the patient must be watched for further possible developments. This can be done without unduly frightening the family by stating that the chances of polio's developing are rather slight. Fortunately most children with the above symptoms recover completely, either because they have a common upper respiratory infection or an extremely mild case of poliomyelitis. Several intensive virus investigations (finding the virus in the stools) have shown that these abortive types of poliomyelitis far outnumber the cases that can be diagnosed clinically.

However, if after several symptom-free days the fever begins to rise again, we may have the second dromedary fever hump which is quite common in this disease. This is the so-called second stage of poliomyelitis. At this time the symptoms present in the first stage return in a more severe form. The fever is higher and more sustained, the malaise more apparent, headache and vomiting usually more pronounced. Now definite symptoms of poliomyelitis may appear. The patient complains of pain in the back and neck, and frequently in one or more of the extremities. On examination, definite stiffness of the back is noted and there is obvious resistance when the examiner tries to bend the neck forward.

At this point a spinal puncture is indicated and if an increased number of cells is found, with or without high protein values, the diagnosis of poliomyelitis is probable. The increased cell count in the spinal fluid is the best single sign of infantile paralysis but, of course, cannot be relied upon absolutely and must be judged in conjunction with other signs and symptoms. In the 10 to 15 percent of polio cases where the cell count is not increased, bulbar symptoms or definite paralysis and muscular weakness can decide the issue.

If, in spite of all efforts, the diagnosis is still in doubt, the patient's best interests are served by treating him as a suspected case of poliomyelitis until a more exact diagnosis can be made. In such doubtful cases it must be emphasized that laboratory and X-ray examinations and careful clinical observation must continue until a definite diagnosis is made. Not infrequently patients are sent to the Kenny Institute, often from quite distant points, with a diagnosis of poliomyelitis without a preliminary cell count. Occasionally the true diagnosis turns out to be osteomyelitis, various forms of meningitis, encephalitis, Guillain-Barré syndrome, tetanus, mumps, or pneumonia. While an early negative spinal cell count would not necessarily have ruled out poliomyelitis, it would at least have encouraged further careful examination.

A majority of the patients do not develop further symptoms but a minority (and the percentage varies in different epidemics) go on to the third stage which is characterized by muscle weakness and muscle paralysis with or without the various forms of bulbar involvement. I have not deemed it within the scope of this paper to go into the minutiae of the diagnosis but wish only to emphasize a few of the more important practical points.

To recapitulate briefly on the diagnosis: During an epidemic of infantile paralysis, physicians must be polio conscious and evaluate critically cases which at other seasons of the year can be dismissed as simple upper respiratory infections.

TREATMENT

Once the diagnosis is made it is of the utmost importance to begin treatment without delay. I realize the value of supportive treatment in poliomyelitis (fluids, food, oxygen, plasma, etc.) and the much greater importance of the treatment of bulbar polio, but these have been described adequately in medical literature. Because very little of practical value has been offered to physicians about the Kenny treatment, I will confine my discussion to that method.

It is frequently said that the Kenny treatment is generally employed in this country; this would be true if the treatment consisted solely of the abandonment of splints and the haphazard application of hot packs. It cannot be repeated too often that properly applied hot foments, while an important part of the

treatment, are definitely of secondary value when compared with the retraining of the muscles. Treatment of all cases in a hospital is advisable; even the mildest forms may suddenly develop bulbar symptoms and require emergency care.

The first step, after the patient is admitted, is to place him in a properly prepared bed. Ideally the bed should have no springs, but a solid board bottom, head, and foot. Because of the difficulty in obtaining such a bed, a 1½- to 1¾-inch plywood board is placed between the springs and the firm cotton mattress. This board should rest on the metal crossbars at the head and foot of the springs. A footboard is separated from the mattress by two 4-inch blocks. Between the spring and the footboard there should be enough space for the patient's toes when he is in the prone position.

As soon as the calf muscles are loose enough to allow 90 degrees dorsiflexion, the patient's feet should be placed against the footboard to stimulate the standing reflexes. Immediately under and over the patient are wool blankets. Wool is used because it prevents chilling between packs, absorbs perspiration, and seems to prevent skin irritations. When sheet or cotton blankets are used the patient is apt to complain of muscle cramps. A cotton drawsheet is used under the head only. The top covers should never be tucked in but should be draped over the footboard.

Before discussing further steps of the treatment, a definition of terms is in order.

Spasm is the term used to describe the highly irritable and painful shortening of muscles, fascia, and subcutaneous tissues. These tight muscles may occur in any part of the body but are most commonly present in the areas of heavy fascia, such as the posterior neck, back (especially the lumbar areas), hamstrings, and the fascia lata. They cannot be relaxed voluntarily nor forcibly lengthened without causing severe pain and increasing the shortening. Spasm definitely is not limited to the antagonists of paralyzed muscles as is frequently stated. A normally contracting muscle will increase in diameter but one affected by poliomyelitis is flattened and narrowed as well as shortened. The shortened muscle will pull the body into the position produced by a normal contraction but will not allow the part to return to normal alinement. Unrelieved muscle shortening is an important factor in the production of deformity. In the early stages this shortening may be treated successfully, but if not corrected it may become a fibrous tissue contracture.

The exact cause of spasm or shortening is as yet unknown. It is possible that the virus attacks the muscles directly. There is clinical evidence to support the thesis that the poliomyelitis virus is not purely neurotropic but may invade the viscera and peripheral tissues. Recent studies showing that the heart is frequently damaged in poliomyelitis support this theory. Virus studies in animals add further confirmation, but the final answer has yet to be determined.

Incoordination is important in poliomyelitis. Patients frequently use wrong muscles or parts of muscles in attempting to carry out activity or may substitute stronger muscles for weaker ones. Coordinate rhythmic function is emphasized in the treatment because coordination is actually more important than strength in the performance of daily activities.

Motor denervation is an irreversible paralysis due to anterior horn cell destruction and, of course, is not alleviated by the Kenny or any other method of treatment.

The actual treatment has for its object the release of abnormal shortening and the establishment of a pattern of movement which is normal or as near normal as possible.

Hot packs are applied for the release of the shortening and the relief of pain. These packs consist of three layers. The inmost layer is made of a knitted material, 75 percent wool and 25 percent cotton. It is cut in lengths ranging from one-half to 1 yard. The material must be soft and lightweight, so that it can be wrapped lightly and smoothly about the area. These inner packs are boiled in plain water and wrung out by a centrifugal extractor, such as those used in laundries or by a clothes wringer, and taken immediately to the bedside for application. These packs are applied at approximately 140° to 160° F., so care must be taken that there are no droplets of water in the packs and that all moisture is wiped from the skin before application of the pack in order to prevent burning.

The middle layer consists of a waterproof material, cut slightly larger than the area to be covered; it is cut in triangular shape for the neck, shoulders, and thighs, and rectangular for the rest of the body.

The outermost layer consists of a dry covering of 100 percent wool material, cut in shape and size approximately like the middle layer. It is the intense heat

on application which makes the patient squirm a little and the gradual cooling that seems most effective. No effort is made to keep the packs hot after application. These packs should extend only over the areas between the joints with the exception of the ball and socket joints (the hip and shoulder, because they are covered by muscles).

The packs are applied every hour for 12 hours during the period of isolation and every 1½ hours in the convalescent stage for a period of 8 hours. They may be applied oftener if there is severe pain, or respiratory difficulty due to tightness of the chest muscles. Prone packs are applied without wrapping for a 1-hour period twice daily. The hot packs are used to alleviate pain and to relieve muscle shortening. However, in order to overcome shortening, the packs must be accompanied by either active or passive movements, through as great a range as is possible without causing too severe pain to the patient.

The application of hot foments is accompanied by a skilled system of joint movements to re-educate nerve pathways. This phase of the treatment is divided into three distinct parts, each directed to a particular portion of the central nervous system. The first step is tendon stimulation of nonfunctioning muscles. The muscles and joints are moved through a short range in an effort to establish a reflex movement. This is done four times daily.

The second step is an attempt to establish mental awareness by passive movements. After the tendon stimulation, the technician explains to the patient the movement which she is going to perform and indicates to him the insertion of the muscle responsible for it. For example, if the wrist flexors are to be exercised, the technician tells the patient that she is going to bend his wrist and indicates the flexors carpi radialis and ulnaris and palmaris longus and the patient is told to "think" of the action while the technician does it. During the early stages of treatment this is done three times during the daily exercise period. This phase is an attempt to re-educate the afferent pathways.

As soon as the patient seems aware of the part or when some motion is noted, active assistive movements are begun. After the patient has been instructed during two passive movements he is told to "pull" from the insertion of the muscle. As coordination and strength improve, the number of active movements is increased and the number of passive movements is decreased. This phase is an attempt to re-educate the efferent pathways. Resistance exercises are not given until the patient has a fair amount of strength and coordination is good, again because coordination is much more important than strength. The patient is encouraged to sit and stand early if it does not increase the tightness or pain and if he can do so with fairly good posture. This portion of the treatment is used particularly to overcome incoordination and muscle weakness.

In the Kenny Institute, the supervision of hot packing and the actual manipulation of the muscles are carried out by Kenny technicians under the direction of the medical staff. In the past, these technicians have been graduate nurses, but from now on they will be graduated as physical therapists, with training made available to both registered nurses and physical therapists. Physical therapists will be given 1½ years of training in the Kenny technic. Graduate nurses who are students in the present and future classes will receive, in addition, a year of physical therapy training. This training schedule is supervised and directed at Elizabeth Kenny Institute by Dr. Miland Knapp, chief of physical medicine in the Kenny Institute and clinical professor of physical medicine in the University of Minnesota Medical School.

After graduation from a physical therapy course the student has 3 months of purely didactic work in anatomy with special emphasis on the origin, insertion, and function of muscles; neurology, pediatrics, psychology, communicable diseases, orthopedics, and physiology. Thereafter for 15 more months she has a sort of an internship, when she treats patients under the very close supervision of the chief technician, interspersed with conferences, round table discussions, and individual instruction.

The treatment outlined above is carried out in all of the four Minneapolis hospitals that treat poliomyelitis patients; namely the University of Minnesota Hospital, the Minneapolis General (municipal) Hospital, Sheltering Arms (a private hospital exclusively for polio patients), and the Kenny Institute. The medical staffs in charge of poliomyelitis are virtually the same in all four institutions, and the physical therapists are all trained in the Kenny technic. This makes for teamwork during an epidemic and permits interchange of patients.

For the past 15 months, the medical staff of the Kenny Institute has had complete direction of all medical activities, and now consists of a chief-of-staff, three

physiatrists or specialists in physical medicine, two pediatricians, 1 internist, 2 consulting othopedists, and 1 visiting orthopedist. A pediatric resident and a pediatric intern from the university hospital rotate through the Kenny Institute as part of their university training. The medical treatment of poliomyelitis must, by its nature, be a matter of teamwork between pediatrician, internist, physiatrist, and orthopedist with other medical specialists called in when needed. Sister Elizabeth Kenny retains connection with the institute as consultant and adviser in the teaching of the technic which bears her name.

An efficient outpatient department is a sine qua non in the treatment of poliomylitis. Mild cases can often be discharged from the hospital early, and receive home treatment, provided that they report frequently and regularly for out-patient checkups.

In the past, overoptimistic reports on the results of the Kenny treatment have been given wide circulation. This has tended to make the medical profession cautious in judging the value of the work. The medical staff is now supervising the collection of data on all the cases treated in the Kenny Institute from 1940 to 1946 inclusive. We hope to complete the work in the near future and publish it in a medical journal. This study will give a reliable, objective report on the final results of Kenny treatment and should go a long way in convincing the physicians that they have been overlooking something of tremendous value to their patients. The medical staff of the Kenny Institute has as its primary goal the spreading of information about the treatment through the medical profession rather than through propaganda to the laity.

The role of the orthopedist in the treatment of poliomyelitis calls for special consideration. In the Kenny Institute the orthopedist is an integral part of the team from the beginning and as a rule takes over when physical therapy no longer shows progress. When any difference of opinion arises between the physician and the orthopedist, a case conference is called and the case is discussed by the entire staff, after which a reasonable meeting of minds usually results.

Any concluding remarks I might make could not improve upon a statement made several years ago by Dr. Wallace Cole, professor and head of the Department of Orthopedics at the University of Minnesota: "The Kenny method keeps deformities to a minimum, utilizes to the maximum the remaining muscle power and almost eliminates curvature of the spine which sometimes follows apparent recovery."

I am indebted to Dr. Miland E. Knapp and Miss Vivian Hannan for assistance in describing the technical treatment.

The Kenny Therapist

For many years it has been my belief that the fields of nursing and physical therapy offer their practitioners greater rewards than any other of the careers commonly chosen by women. It has been my privilege to know at firsthand the great satisfaction that comes from administering to the sick and ailing, and I have seen this satisfaction reflected many times in the nurses and physical therapists who have served my patients.

More recently, a great deal of my work has been with the Kenny therapists at Elizabeth Kenny Institute and the other Kenny treatment centers. Here, indeed, would seem to be a high achievement for a nurse or a physical therapist. In comparing the work of all three groups, I do not hesitate to venture the opinion that the work of the Kenny therapist offers a full measure of personal satisfaction, spiritual reward, professional attainment, and material compensation.

With the growing demand for full Kenny treatment for polio, and the great need for additional trained Kenny therapists, I urge graduate nurses and physical therapists to give serious consideration to the part they can play in helping us combat the scourge of polio and to the advantages a career as a Kenny therapist holds.

E. J. Huenekens, M. D.,
Medical Director, Sister Elizabeth Kenny Foundation, National Headquarters, Minneapolis, USA.

THE KENNY THERAPIST FIGHTS POLIO CRIPPLING

Qualifications and background

Registered nurses and physical therapists, male or female, who are under 40 years of age and who have the personal qualifications felt needed for the work are eligible for the therapist training course offered by the Sister Elizabeth Kenny Foundation. Scholarships provide funds for living expenses during training. Tuition is met by the Kenny Foundation.

The training combines practical and didactic work. This is conducted by medical personnel and teaching therapists at the internationally famed Elizabeth Kenny Institute at Minneapolis with some classes at the University of Minnesota. Trainees live in quarters of their own choosing and are given every assistance in securing their abode.

The job after graduation

Training completed, the Kenny therapist is qualified to treat polio cases, under medical supervision and in accordance with the technique established by Sister Kenny, from the onset of the disease until the patient is ready for discharge. The work of the Kenny therapist is carried on in treatment centers operated or sanctioned by the Kenny Foundation.

The treatment centers are located in various parts of the United States. The Kenny therapist is given the utmost degree of latitude possible when it comes to selecting the center in which he or she wishes to serve.

The therapist's primary duty is to administer active and passive exercises, muscle and tendon stimulation to restore alienated or pseudo-paralyzed muscles to function, and neuromuscular retraining to insure maximum development of normal patterns of motion.

Under normal conditions, the Kenny therapist is relieved of the physical work of preparing and applying hot packs, this work being delegated to others.

THE TRAINING THE KENNY THERAPIST IS GIVEN

The training of the Kenny therapist is made up of an intensive course of study in the Kenny concept of poliomyelitis and the treatment for that concept. This specialized training is supplemented by courses in anatomy and physiology offered by the University of Minnesota Medical School.

Students in both the registered nurse and physical therapist classifications are requested also to register for the course, principles of learning and methods of teaching, provided by the department of nursing education at the University of Minnesota.

Training is divided into two periods. The first includes 6 months of didactic and theory followed by 6 months of clinical study. The second is made up of 12 months of practical experience and includes necessary lectures and demonstrations. Trainees are expected to serve through two periods of polio incidence during the course.

Students divide their time between classroom instruction and work with polio patients. This is under individual supervision of graduate Kenny therapists. Before receiving a certificate, the student must demonstrate complete ability to manage polio cases from admission to final discharge.

In addition to the regular course, qualified nurse graduates will be offered enrollment in certain accredited schools of physical therapy for a 1-year course which will lead to a certificate and physical therapy recognition. Tuition will be provided by the Kenny Foundation.

THE CURRICULUM INCLUDES—

Study of anatomy, physiology, neurology, pathology, and applied dermatology as related to infantile paralysis. Epidemiology and general management of contagious diseases. Theory of care of poliomyelitis and observation of practical work.

Practical management of poliomyelitis patients under supervision. Nursing procedures in different types of cases with special reference to the disturbance in the peripheral tissues as observed in acutely ill patients. Experience in treating longer standing cases under supervision.

Study of the architecture of the peripheral tissues of the body and of the disturbances caused by the disease in this region. Consideration of classification and action of muscles as applied to the restoration of function in bodily mechanics. Practical experience in treatment of acutely ill patients under supervision.

Experience and responsibility of treating cases under supervision. Management of poliomyelitis from the onset to the maximum degree of recovery.

THE KENNY METHOD

Hot packs

Hot packs and attendant procedures help restore shortened muscles to normal length and prevent deformities. Hot packs as introduced by Sister Kenny were a departure from those used as a part of the conventional treatment of polio. The usual practice in use of hot foments, or packs, had been to swathe an entire limb or body area in a single pack.

Since Miss Kenny's technique stresses the importance of joint consciousness and free articulation of all joints, the packs she developed are applied separately to each section of a limb, leaving the joints entirely free of restraint.

This feature of the Kenny technique has not been generally adopted by those treating polio, even though the use of some form of hot pack has became almost universal since Sister Kenny focused attention on their value in work with this disease.

Muscle and tendon stimulation

Muscle and tendon stimulation administered by the Kenny therapist is designed to restore alienated or pseudoparalyzed muscles to full function. The therapist learns the many forms of these specialized types of stimulation and manipulation during her training period. Patient and skillful application of these stimulating techniques will frequently restore usefulness to muscles which appear to be completely paralyzed.

Neuromuscular retraining

Since the Kenny method stresses the importance of developing normal patterns of motion to the fullest extent possible, neuromuscular retraining administered by the Kenny therapist receives close attention. Patiently correcting improper patterns of motion as they appear, the therapist spends many hours in teaching her patient the proper way to move muscles which have been weakened or alienated by polio.

Full Kenny treatment is administered only by qualified Kenny therapists under the supervision of doctors who are familiar with the Kenny concept and treatment of poliomyelitis.

The first step

When the patient is ready to take the first step unaided by the Canadian crutches, or walking sticks, used as supports while learning to walk again, the Kenny therapist is rewarded by the knowledge that her skill has restored to normal living a polio victim who, without such help, might have faced a life of helpless dependency.

The Kenny treatment is provided at no charge by the Sister Elizabeth Kenny Foundation. Thousands of polio patients, many of them in foreign countries, today give thanks to the Kenny treatment, skillfully administered by Kenny therapists, for their return to normal living.

KENNY THERAPISTS OFFER OUTSTANDING SERVICE IN EMERGENCIES

As the patient load at Kenny treatment centers permits, the Kenny Foundation cooperates with doctors and health authorities in other localities by providing Kenny therapists on an emergency basis to assist in the handling of local situations. Upon completion of such emergency duty, these personnel return to their regular assignments. In a few instances, the Kenny Foundation has also assigned therapists to work with doctors in areas not convenient to Kenny treatment centers, an an aid to these medical men in evaluating the Kenny method. Several Kenny therapists have accepted assignments abroad.

Trainees' expenses are met by scholarships

Financial assistance in the form of scholarships from the public contributions made to the Kenny Foundation is provided for nurses and physical therapists who wish to enter training to become Kenny therapists. Tuition for all courses is also paid by the Kenny Foundation. Scholarships are adequate to permit a comfortable standard of living during training. Persons who successfully complete the course for Kenny therapists receive a certificate from the Sister Elizabeth Kenny Foundation. This certificate indicates the ability of the holder to treat polio and to supervise others in its management, according to the technique established by Miss Kenny.

SALARIES ARE ABOVE AVERAGE AND VACATIONS ARE LIBERAL

Salaries of Kenny therapists are above the average for the nursing and physical-therapy professions. Those who have supervisory ability are given opportunity to increase their earnings accordingly. Vacation schedules are provided during training. After graduation, these schedules allow 2 weeks' vacation with pay at the end of the first year, 3 weeks after 2 years, and 4 weeks at the end of the third year and every year thereafter.

How to apply for Kenny therapist training

Application blanks will be furnished upon request. Address communications to: Director of Training, Sister Elizabeth Kenny Foundation, 2400 Foshay Tower, Minneapolis 2, Minn.

The CHAIRMAN. The committee will adjourn until 2 o'clock, at which time we will take up the subject which I indicated this morning with some very distinguished witnesses who will appear.

(Thereupon, at 1:07 p. m., Tuesday, October 6, 1953, a recess was taken until 2 p. m. of the same day.)

AFTERNOON SESSION

(The committee reconvened at 2 p. m., at the expiration of the recess.)

The CHAIRMAN. The committee will come to order.

The committee will hear testimony this afternoon on the subject of gamma globulin, a blood derivative which in recent years has found increasing use in the practice of medicine. We are all interested in what has been learned about this new weapon and its potentiality in fighting disease. It is a subject which affects all of us, because gamma globulin can only be produced from human blood, and its continuing use on a large scale depends on the willingness of the American people to contribute their blood for a worthy purpose.

During the past year in particular gamma globulin has become almost a household word. We have heard of its use this past summer in combating polio epidemics and we have heard of the urgent need for expending our limited supplies wisely where they will do the most good.

Naturally, we are all deeply concerned about what the experts in science have developed which will help protect American children against the paralysis of polio. And we wish to do everything humanly possible to make gamma globulin available to all who need it.

Polio is not the only disease against which this blood derivative has been tried with success. For several years now, I understand, gamma globulin has been used against measles. Its value has also been demonstrated against jaundice. Perhaps there are other uses which may be found for this weapon.

The committee is interested in obtaining a broad appraisal of the present status of gamma globulin. The witnesses who have kindly consented to testify will discuss major problems in various areas—the job of obtaining blood, the allocation and distribution of the processed product, an evaluation of gamma globulin benefits, and the outlook for the future.

I understand that there is a prepared statement from the Office of Defense Mobilization and one by the Public Health Service on the matter of distribution and one from the Public Health Service deal-

ing with evaluation studies now being conducted. Are there any other prepared statements?

General GRANT. I have one from the Red Cross.

The CHAIRMAN. I would like at this time to state that all these documents will be entered officially into the record of these hearings.

There has been distributed to the members of the committee, the witnesses, the press, and others who are interested, the agenda which will serve as the basis for our discussion this afternoon.

I would like at this time to enter this and the list of witnesses into the record.

(The material referred to follows:)

GAMMA GLOBULIN AGENDA

1. Purpose of this hearing—statement by the chairman.
2. Introduction of witnesses.
3. Scientific background on gamma globulin.
   - What it is.
   - Development of gamma globulin.
   - Basis for its use against poliomyelitis.
   - Difference between gamma globulin and specific vaccines.
   - Effect of gamma globulin on natural immunizing processes.
4. The basic raw material—blood.
   - Amounts of blood necessary for defense needs.
   - Amounts of blood necessary for civilian needs.
   - Red Cross processing of blood for gamma globulin.
   - Cost of gamma globulin.
   - Who pays for it.
5. Development of present system for use of gamma globulin against poliomyelitis.
   - Relationship of national blood program and defense needs to gamma globulin.
   - Activities of voluntary and official agencies in development of present system.
   - The Office of Defense Mobilization Plan.
6. Allocation and distribution.
   - The gamma globulin supply.
   - Basic and additional allocations to States.
   - Mass prophylaxis to counties of high incidence.
   - Allocations for research purposes.
7. State experience in using gamma globulin.
   - State plans for use of gamma globulin.
   - Procedures in using basic and additional allocations.
   - Mass prophylaxis versus contact immunization.
   - Problems encountered—amendments to State plans.
   - Reaction of the medical profession.
   - Public reaction.
   - Recommendations.
8. Biological control of gamma globulin.
   - Legal responsibility of Public Health Service.
   - Variations in potencies of gamma globulin.
   - Comparative effectiveness of gamma globulin against all strains of virus.
   - Development of testing techniques.
9. Gamma globulin evaluation studies.
   - Need for and objectives of evaluation.
   - Plan of analysis.
   - Present activities.
10. Recommendations for future use of gamma globulin against poliomyelitis.

PARTICIPANTS

Dr. Justin M. Andrews, Assistant Surgeon General, Bureau of State Services, Public Health Service.
Dr. Joseph Stokes, physician in chief, Children's Hospital, Philadelphia, Pa.
Dr. Gaylord Anderson, director, School of Public Health, University of Minnesota, president, American Public Health Association.
Dr. David N. W. Grant, director, American Red Cross blood program.

Dr. W. H. Aufranc, Director, Health Resources Staff, Office of Defense Mobilization, Washington, D. C.
Dr. Ralph S. Paffenbarger, Division of Civilian Health Requirements, Office of the Surgeon General, Public Health Service.
Dr. Roy Norton, State health department, Raleigh, N. C.
Dr. Victor Haas, Director, Microbiological Institute, United States Public Health Service.
Dr. Alexander Langmuir, Communicable Disease Center, Atlanta, Ga.

The CHAIRMAN. I understand that Dr. Justin M. Andrews, Assistant Surgeon General of the Public Health Service, has been selected by common consent of the participants to serve as discussion leader during this afternoon's hearings on gamma globulin.

Dr. Andrews, it has become our practice at these informal hearings to ask each member of the witness panel to rise and identify himself, both for the record, for the benefit of the reporter reporting these hearings, and in order that the witnesses may be individually known to the members of the committee. After this ceremony is completed, will you please proceed with the discussion. The members of the committee may want to ask questions from time to time and the witnesses may want to question each other. Our only purpose here is to place before the American people the maximum amount of useful information on this very important subject.

Now, Dr. Andrews, you may proceed to introduce the members of your panel. I have before me a résumé of their background and experience and their activities which is really impressive. I can readily realize that modesty might prevent you gentlemen from speaking in the detail that I have before me as to your respective background and experience. If that is the case—and I assume it is—I will be very glad to submit to the reporter this statement so that it can be made a part of the record as you introduce each one.

Dr. Andrews, you may proceed with your introductions.

Dr. ANDREWS. Mr. Chairman, I am honored to introduce this distinguished group of witnesses this afternoon.

First of all we have Dr. Joseph Stokes, physician in chief, Children's Hospital, Philadelphia. He was born in Morristown, N. J. M. D., University of Pennsylvania, 1920, instructor, associate professor and since 1938 William H. Bennett professor, School of Medicine, University of Pennsylvania; chief, pediatrics service, University Hospital, 1939; physician in chief, Children's Hospital, Philadelphia, 1939; with Army Epidemiology Board, United States War Department, 1942–45; president, Society for Pediatrics Research; fellow, American Pediatric Society; associate, American Physicians; Society of American Bacteriologists; American Medical Association; American Academy of Pediatrics; American Society of Clinical Pathologists.

The CHAIRMAN. Dr. Stokes, are you any relation to the Stokes of New Jersey?

Dr. STOKES. Yes, sir; I was born in Morristown, N. J.

The CHAIRMAN. We will not hold that against you. That family has a very honorable background in our State.

Dr. ANDREWS. Next is Dr. Gaylord Anderson, and you are already acquainted with him, as he testified this morning.

The CHAIRMAN. Yes, sir; he was here this morning and gave us very important testimony.

Dr. ANDREWS. Our next panelist is General Grant, director of blood program, American National Red Cross. He was born in Richmond,

Va. M. D., University of Virginia; graduate of Army Medical School, School of Aviation Medicine, Air Corps Tactical School, Chemical Warfare School; major general, United States Air Force (retired). As Air Surgeon, United States Air Force, during World War II, was responsible for scientific research which solved many medical and physician problems encountered by airmen in high-altitude flying. Director of blood program, 1951; fellow, American College of Surgeons; member, Military Division, Order of the Bath; Association of Military Surgeons of United States; American Medical Association; associate of aviation medicine; District of Columbia Medical Society; Academia Brasileira de Medicina Militar.

Next is Dr. Will H. Aufranc, Director, Health Resources Staff, Office of Defense Mobilization. He was born in Cedar City, Mo. M. D., Medical College of Virginia, 1933; M. P. H., Johns Hopkins, 1941; city venereal disease control officer, Portland, Oreg.; State venereal disease control officer, Oregon; acting director, local health services for the State of Oregon, 1943–46; Acting Chief, Venereal Disease Division, Public Health Service, prior to assignment to the Office of Defense Mobilization as Director, Health Resources Staff; member, Americal Medical Association; American Public Health Association.

Our next panelist is Dr. Ralph S. Paffenbarger, Jr., epidemiologist, Division of Civilian Health Requirements, Public Health Service. He is a native of Ohio. M. D., Northwestern University Medical School; M. P. H., Johns Hopkins School of Hygiene and Public Health; epidemiologist, Communicable Disease Center, 1947–53; on assignment as research associate, Poliomyelitis Laboratory, Johns Hopkins University, 1952–53.

Next is Dr. J. W. R. Norton, State health officer, North Carolina State Board of Health. M. D., Vanderbilt University School of Medicine, 1928. Colonel, Army Medical Corps, during World War II and medical inspector for Seventh Army in European theater. M. P. H., State health officer, North Carolina. Fellow, American Public Health Association; member, American Medical Association.

Next is Dr. Victor H. Haas, Director, National Microbiological Institute, National Institutes of Health, Public Health Service. He was born in Cincinnati, Ohio. M. D., University of Cincinnati, 1932. Intern and staff member, Marine Hospital, Public Health Service, New York, 1931–33. Staff officer, United States Army Forces, China-Burma-India theater, 1942–43, on detail from the Public Health Service. Fellow, American Medical Association; member, American Society of Tropical Medicine and Hygiene; American Public Health Association; Association of Military Surgeons of United States.

Our next panelist is Dr. Alexander D. Langmuir, Chief, Epidemiology Branch, Communicable Disease Center, Public Health Service. He was born in Santa Monica, Calif. M. D., Medical College, Cornell University, 1935; M. P. H., Johns Hopkins, 1940. Epidemiologist, United States Army Epidemiology Board, 1942–44; major, United States Army, 1944–45; associate professor, Johns Hopkins, 1946–49; Director, Epidemiology Division, Communicable Disease Center, 1949–. Fellow, American Public Health Association; American Medical Association; American Epidemiology Society; American Statistical Association; American Federation for Clinical Research; Baltimore Medical Society.

I am sorry to say that we are shy one important witness which we had hoped to bring before you. He is Dr. Robert F. Korns, who is the State epidemiologist of New York State. He has unfortunately been grounded by the weather. We had a telephone call about an hour ago disclosing that he had not left Albany, but if he can arrive by 4 or 4:30 p. m., I have urged him to take the chance that you might still be in session so that he could appear at that time. In the event he does not come, may I respectfully request that his remarks be incorporated and a statement included in the record with the balance of the statements which have been submitted?

The CHAIRMAN. We certainly shall be glad to comply with that request.

(The statement referred to follows:)

STATEMENT OF DR. ROBERT F. KORNS ON POLIOMYELITIS-GAMMA GLOBULIN IN NEW YORK STATE

DESCRIPTION OF THE PROGRAM

The New York State Health Department, in common with other departments, was disturbed early this year by the prospect of the need to develop a scientifically sound, and at the same time, acceptable program of allocating gamma globulin, as far as the public and medical profession was concerned, in the face of the limited supply. Some time before the Federal plan was announced, we had met with our local health officers association and representatives of the State medical society to discuss these matters and had formulated a tentative plan, which later proved to be not particularly different from the recommended national program.

First of all, we emphasized that this material had limited value, and that it was of no use in the treatment of poliomyelitis. With the information available at that time as to the anticipated quantity to be allocated to the State, we worked on the basis that we would probably have an average of 60 milliliter per reported case. As it turns out, with supplemental allocations, the average amount per case will be greatly in excess of this. I believe our program differs from that developed in most other States, in fact, it may be unique, in that we inserted into the original published plan the idea that nonhousehold contacts of poliomyelitis patients would also be candidates for prophylactic gamma globulin. First attention, obviously, was given to household contacts and we defined for our purposes what we considered to be a household and what was deemed to be the period of communicability of poliomyelitis. We restricted use to household members under 30 years of age, since the attack rate in older persons is much lower and the dosage of gamma globulin would be proportionately higher. One exception to this general rule was that pregnant women in the household would receive gamma globulin, no matter what their age. Somewhat similar rules were established for nonhousehold contacts, although the age limit was set at 21 years. Although we attempted to define nonhousehold contact, the responsibility for final decision as to which persons would get gamma globulin in this group actually rested with 1 of our 38 full-time health officers.

We felt that it was impossible to establish iron-clad rules that could be applied universally, although we wished to give enough substance to the rules so that the health officer would not be left holding the bag. Effective contact was labeled as "direct physical contact with the patient," and availability of gamma globulin was limited to persons who had had such contact within the past 12 days. Here again, pregnant women, even though they exceeded the age limit, were included in the program, as well as nurses under 30 years of age who were involved in the care of poliomyelitis during the communicable stage (labeled as 3 days before to 7 days after onset of symptoms). We followed the national recommendation that the dosage be 0.14 milliliter per pound of body weight and placed no ceiling on the amount given to an individual. We did not limit the amount given to the family or extra-household contacts of a given case to 60 milliliters. Sometimes this figure was exceeded severalfold where circumstances seemed appropriate, but we were committed to the idea of an average use of 60 milliliters per reported case. We did not include the use of gamma globulin for the contacts of so-called suspected cases of poliomyelitis since we feared that this would lead to misuse to the detriment of more legiti-

mate requests. However, we find in retrospect that gamma globulin was given to contacts of patients who were reported to have poliomyelitis but whose illnesses were later diagnosed as some other condition. This type of situation is inevitable, since obviously it is very desirable to give gamma globulin to contacts at the earliest possible moment, even before final diagnosis is achieved.

The mechanics for distribution of this precious material were firmly established in a rather rigid manner, so that it was practically impossible for misuse of gamma globulin to occur. Our State laboratory represented the main repository of material. Sixty-eight carefully selected laboratory supply stations, scattered throughout the State, served as substations. These represented a portion of the 180 existing supply stations involved in the distribution of biologicals and other materials furnished by the New York State Department of Health. Our reason for restricting gamma globulin to this group was to maintain better supervision of supplies. Custodians of these supply stations had no authority to allocate gamma globulin. The only mechanism available was through the application on the part of the attending physician to 1 of the 38 full-time health officers, who assessed the appropriateness of the request, and supplied the physician with an allocation number. He, in turn, either personally or by messenger, transmitted this number to the supply station and obtained gamma globulin in the requisite amount. In order to keep complete control of the supply, a similar distribution plan was established for gamma globulin used in the prophylaxis of measles, infectious hepatitis, and German measles in the pregnant mother exposed to the disease in the first trimester. It was necessary to keep this system in operation 7 days a week. As can be imagined, this was quite a responsibility and headache for these health officers, as well as for others participating. A series of record forms, both for administrative and research purposes, was developed for the supply station to keep close tabs on the inventory, and for the district health officer to record pertinent information about the allocation. The forms were reviewed currently by the allocating health officers and by the central office of the State health department. I honestly believe that very little mishandling of gamma globulin occurred, unless there was gross prevarication on the part of attending physicians and others involved. Frankly, we had anticipated more trouble than actually did develop and, as of now, we are remarkably pleased with the smoothness of this operation. I shall comment briefly below on some of the annoying problems encountered which may be corrected in the future. The attached documents, outlining additional details of our program, may be referred to, if indicated.

It was essential to modify this original plan somewhat during October, following the allocation of an additional supply of gamma globulin to the State. Originally, we had received 158,820 milliliters and, during late August, a supplemental amount of 8,870 milliliters. Although we anticipated an additional supply, we were somewhat shocked by the size of the amount allocated to us beginning at the end of September, namely, 181,630 milliliters. Our existing plan had not contemplated this windfall. It was, therefore, necessary to expand the program, and I mention below some of the problems connected with this. At this point, I need merely say that we did not change the basic plan because this seemed to be working satisfactorily, but we did expand the amount being used per case to 100 milliliters and included certain other specific items, such as the use of gamma globulin in individuals being prepared for tonsillectomy or other oral surgery during the poliomyelitis season. We also raised the age limit in household contacts to 40 years and allowed for the use of gamma globulin in boarding schools where poliomyelitis occurred, since this group would have more intimate exposure than the ordinary day schools. We specifically excluded the use in ordinary school contacts of cases, since we estimated that this group would be several times larger than the number we could immunize with the available supplies of gamma globulin.

MASS PROPHYLAXIS

Although our original plan did not contemplate the use of gamma globulin for mass prophylaxis, except under most unusual circumstances, New York State did sponsor one such program in Steuben and Chemung Counties, immunizing a total of 37,000 children, aged 6 months to 10 years. The only points worthy of mentioning here relate to the problem of predicting the trend of poliomyelitis incidence in a given area so as to allow selection in advance, or at least early in the epidemic wave, those communities where mass prophylaxis might achieve some benefit. We studied this matter very carefully before requesting additional gamma globulin for these two counties, and satisfied ourselves that we could

anticipate a major epidemic in this area. However, we are not sure that our decision was right, and are not convinced that a technique for achieving this information is available yet because of the frequent erratic behavior of poliomyelitis. Certainly, the thesis that the poliomyelitis curve of incidence is a given county or community follows the behavior of the disease in the State as a whole is a weak one. As you know, this has been the essential screening procedure used this year throughout the country for consideration of mass prophylaxis. The value of mass use of gamma globulin hinges entirely on our ability to accurately select those areas destined to be major epidemic foci. We hope that the experience gained this year will be of use in making this possible next year. If, indeed, this were possible, mass use of gamma globulin would certainly have strong justification.

As it turned out, however, the program carried out in Chemung and Steuben Counties during a 2-day period, July 11 and 12, was an administrative success; namely, it was accomplished with only brief preparation and in a short space of time. Everyone seemed pleased with the whole program. However, when one attempts evaluation of the amount of poliomyelitis prevented or the extent of modification of paralysis, one must admit that even though so-called experts were following the situation very closely, we are at present unable to say with certainty that gamma globulin prevented any poliomyelitis. By the same token, we cannot say that it did not do so. This situation stemmed from the fact that a controlled study was not conducted, but rather an administrative service program, based on the assumption that gamma globulin would do some good. As may have been mentioned elsewhere in this testimony, one of the disappointing aspects in evaluation centered around the shift in the age distribution of reported cases after gamma globulin was given. In these two counties, before the mass program 75 percent of reported cases were under 10 years of age, while during the post gamma globulin period, only 35 percent were in this age group. On the surface, one would immediately conclude that since gamma globulin was given to children from 6 months to 10 years of age, the shift was due directly to the prevention of the disease in this group. Unfortunately for the purpose of evaluating the benefits obtained from gamma globulin we, as well as others, have found that shifts of this sort occurred frequently in poliomyelitis epidemics. Actually, in seven other recent outbreaks in New York State where no gamma globulin was used, we have observed age changes as striking as these.

The recently published article in Look magazine, criticizing health departments for not having used more gamma globulin for mass prophylaxis, is hardly justified with respect to New York State, even though this State is selected for adverse comment in that article. In only one other county did the State exceed the critical level established for mass prophylaxis by a sizable margin. At the time we were notified of the appropriateness of this county for mass prophylaxis, we already knew of 16 cases. During the following week, six additional cases developed. Even under the best circumstances, we would not have been able to vaccinate the population before that time. During the succeeding 5 weeks, when one would have expected gamma globulin to do some good, only a single case of poliomyelitis occurred, and during the 6 weeks since that period, only 2 other cases have developed in residents of this county. Obviously, it would have been unrewarding to administer gamma globulin on a mass basis at that point and, frankly, because of the uncertain behavior of poliomyelitis, we would hardly have been justified in jumping into the situation before that time.

ACCEPTANCE OF THE PROGRAM BY THE MEDICAL PROFESSION AND THE GENERAL PUBLIC

One can say without any qualification that the medical profession accepted the program wholeheartedly and made every effort to comply with its provisions. This was due, in part, to prior agreement with the State medical society as to how the program should be developed, and partly to the existing good rapport between the State health department, through the full-time health officers, with the practicing profession. I think we all realize that this was an unpleasant and difficult job that had to be done, and that the scheme established for selecting the groups which deserved priority seemed sensible to everyone, in view of the limited supply of gamma globulin.

The health officers involved in allocation had many headaches in trying to limit the distribution to household contacts and intimate nonhousehold contacts, but in New York State, exclusive of New York City, this did not present a major problem. A few large cities found it necessary to limit distribution to household contacts alone, because they were unable to define adequately and maintain such definitions for the nonhousehold contact group. New York City, on the other hand, was quite different, with organized pressure groups that were very difficult

to cope with. For this reason, New York City from the start never administered gamma globulin to nonhousehold contacts. For the same reason, they did not give it to nurses in contact with poliomyelitis because, if they had done so, many thousands of nurses would have been possible candidates and this would have utilized the entire existing supply. The most critical problem arose in connection with summer camps. In the upstate area these situations had been handled individually as they arose without too much trouble. On the average, 250 milliliters of gamma globulin was utilized in intimate contacts, such as bunk mates and those caring for the reported case. Actually, poliomyelitis occurred in 27 camps, to our knowledge. In 21 of these, only a single case occurred. In two there were 2 cases, in one 3 cases, and in two 6 cases. The initial difficulty centered around a camp housing residents from New York City. Gamma globulin was given to bunk mates and other intimate contacts, but this did not quiet the excitement of parents, who marched on city hall in New York City and demanded the mass use of gamma globulin for the entire camp population. Because the circumstances were somewhat unique, there having been three reported cases from this camp, their wish was granted, even though we resisted it strongly. This immediately led to clamoring for gamma globulin by several other groups, and it was found necessary to accede to the wishes of one additional camp. This, however, merely supplied fuel to the fire and the New York City Health Department was immediately faced with several other similar situations. Even though the camp season was approaching an end, we visualized that use in this way had to stop or our existing supply would be rapidly depleted. The attitude taken about camps, we feared, would be translated to the schools, which were about to open. At that point, we conferred with authorities in Washington and established a firm stand that the available and anticipated supplies of gamma globulin would not allow us to use it in this way.

There have since been several other disturbing episodes of similar nature, but we have been successful in resisting public pressure. This policy was based on our conviction that the use of gamma globulin in household contacts deserved priority. Obviously, we need to have this opinion verified by study of the experience this year. In general, difficulties with allocation did not arise unless individuals or camp grounds got the impression that gamma globulin was being given to other individuals or organizations with similar justification. Thus, when we gave in to the pressure from one camp, all camps wanted it, and the same difficulty occurred, on a smaller scale, with respect to individuals. In other words, it was necessary to be strictly impartial in making these decisions, and be guided by the available supply, the extent of exposure, and the apparent susceptibility of the individuals.

POSSIBLE CHANGES FOR NEXT YEAR

At this time, it is impossible to fully evaluate the experience of this summer and fall and to define clearly what should be done next year. These decisions depend so much on how much poliomyelitis will occur, how much gamma globulin will be made available to New York State; will strings be attached to how it should be used, namely, for mass prophylaxis or for use in household and nonhousehold contacts? Will mass prophylaxis be limited to consideration of entire counties or can it be used in smaller communities?

We are currently lacking fundamental information as to the risk of acquiring poliomyelitis in certain segments of the population. We need information as to the secondary poliomyelitis attack rates in camp groups of different ages. If it is shown that the likelihood of developing poliomyelitis in camps where a single case has occurred is comparable to that in household contacts of the patient, obviously, this group should receive a comparable degree of attention. In similar fashion, we need information of this sort for classrooms of different grades where poliomyelitis has occurred in one of the children. What is the likelihood that some of the others may develop the disease? With this sort of information, one could develop a more logical and rational allocation system. Obviously, our attitude about plans for next year is colored by what we should expect with reference to poliomyelitis vaccine. We gather that an extensive field trial will be attempted this winter, and that evaluation will be conducted during next year's epidemic, so that mass use of this material will not be in the picture for another year or two.

We need desperately as technique for predicting what the incidence of poliomyelitis will be in given communities as a basis for the application of mass gamma globulin prophylaxis. I am not convinced that we have such a tool and

am, therefore, reluctant to recommend indiscriminate use of the mass prophylaxis approach. More information is needed on the risk of poliomyelitis in discrete segments of the population. Our own studies, for example, show that nurses suffer from an attack rate of poliomyelitis three times greater than nonnurses of the same age and sex group. Similar studies with physicians I am sure would indicate that the attack rate in this group is many times higher than others of similar age. Since even though the gamma globulin supplies will be increased, they will still be limited, we must search out all groups that are subject to special risk and give them prior attention. Perhaps the use in household contacts should be extended to all age groups. Our own experience indicates that the secondary attack rate per 1,000 individuals in the household is 5.1 in the household members aged 30 to 39, and 3.6 in those over 40 years. These compare with the attack rate in the general population in these age groups of 0.27 and 0.02 per 1,000 population, respectively. Hence, even though poliomyelitis occurs rarely in these age groups, it is far more frequent in persons in the families of poliomyelitis patients.

Obviously, the studies undertaken this year for evaluating mass prophylaxis and the use of gamma globulin in household contacts undertaken by individual States and by the United States Public Health Service should be carefully examined to determine what is the most appropriate way to use this material. In terms of the public clamor for gamma globulin, I think we should reiterate again and again through various types of publicity that gamma globulin has severe scientific and practical limitations in the prophylaxis of poliomyelitis. We should attempt to define more accurately the groups of individuals who will be candidates for gamma globulin, so that we will avoid the open-ended category that presents so many problems to the health officer who has to shut the door when the supply is exhausted. It is hoped that next year we will have a clearer notion at the outset of the poliomyelitis season as to how much gamma globulin we are to receive, so that we can plan properly for the entire season. This year we were seriously embarrassed by lack of this knowledge. The unexpected doubling of our supply as of October 1 presented us with the difficulty of discovering ways of using this material to best advantage without running the risk of wasting it or undermining the firm stand that had been established earlier with respect to the use of this material in large groups, such as camps, schools, etc.

Despite the headaches and, in many ways, uncalled-for excitement that centers around the use of gamma globulin, which has so little prophylactic value, I think we all have reason to be proud of the way the program has been carried out.

STATE OF NEW YORK,
DEPARTMENT OF HEALTH,
EXECUTIVE OFFICE,
Albany 1, May 4, 1953.

DEAR DOCTOR: Attached is a copy of the plan covering the 1953 distribution of gamma globulin for poliomyelitis prophylaxis and a list of the full-time local health officers through whom supplies of gamma globulin may be obtained.

This distribution plan has been developed by the Department after consultation with full-time local health officers and the council committee on public health and education of the Medical Society of the State of New York. It is the aim of the plan to make the most effective possible use of the limited supply of gamma globulin which will be allocated to New York State from the national pool.

Since gamma globulin is recognized to be of value only in poliomyelitis prophylaxis and not in treatment, the allocated supply will be provided for prophylaxis only.

In accordance with the official recommendations of the Federal Office of Defense Mobilization, gamma globulin will be made available to contacts of poliomyelitis patients under the conditions outlined in the plan. The administration of gamma globulin to contacts is based on sound epidemiological evidence which indicates that the risk of getting poliomyelitis is many times greater among household contacts of a patient during the communicable stage than it is among the general population. Detailed discussion of this point will be found in the article by Hammon et al., JAMA, April 11, 1953; pages 1272–1285.

Since gamma globulin will be allocated to New York State at an average rate of 60 cc. per reported case and will be reallocated locally on this same basis, the amount used for contacts of a reported case must not exceed this average rate.

We are all well aware of the great public concern about poliomyelitis and the interest that centers around this useful but limited control measure. To make

the best use of the critically short supply of gamma globulin and to minimize public anxiety will require close working relationships between private and public health physicians. We pledge you our fullest cooperation in the difficult days ahead of us.

Sincerely yours,

HERMAN E. HILLEBOE, M. D.,
Commissioner of Health.

1953 DISTRIBUTION OF GAMMA GLOBULIN FOR POLIOMYELITIS PROPHYLAXIS

Gamma globulin allocated to New York from the national pool will be distributed in accordance with the plan outlined below. This plan is effective May 15, 1953. Gamma globulin will be distributed locally as soon as supplies are received from the national pool.

If circumstances affecting the supply of gamma globulin change, the distribution plan will be amended accordingly and you will be notified immediately.

I. USAGE

Gamma globulin is of recognized value only for the prophylaxis of poliomyelitis and not for its treatment. Because gamma globulin is in critically short supply its usage must be limited to contacts of reported, diagnosed cases. It cannot be provided for contacts of suspected cases.

II. AVAILABILITY

New York State will be allocated gamma globulin from the national pool on the basis of an average of 60 cc. per reported case. Gamma globulin will be made available to full-time local health officers at this average rate for distribution to physicians for use in the following groups:

(*a*) *Household contacts.*—In the allocation of gamma globulin first consideration will be given to members of the patient's household who have been in direct contact. Such contact shall have been at some time within the previous 12 days, and while the patient was in the communicable stage. The communicable stage is defined as 3 days before to 7 days after onset of illness. Use of gamma globulin will be limited to household contacts under 30 years of age and to pregnant women of all ages.

(*b*) *Nonhouschold contacts.*—In view of the limited supplies of gamma globulin, and because there is less likelihood of intimate exposure, only secondary consideration can be given to nonhousehold contacts. Within the 60 cc. average allotment per case the health officer may provide gamma globulin for administration to persons not members of the patient's household who have had direct physical contact at some time during the previous 12 days with a reported case in the communicable stage (as defined above). Use of gamma globulin will be limited to nonhousehold contacts under 21 years of age, pregnant women of all ages, and nurses caring for poliomyelitis patients in the communicable stage.

III. DOSAGE

The recommended dosage of gamma globulin for poliomyelitis prophylaxis is 0.14 cc. per pound of body weight. Thus, for example, a 50-pound child would receive 7 cc. Because of the limited supply the use of gamma globulin must be restricted to one dose per person per epidemic year.

IV. PROCUREMENT

Gamma globulin may be procured by physicians through the full-time city, county, or district health officer in his area by furnishing the health officer with certain information regarding the patient and his contacts. To facilitate prompt procurement and administration of gamma globulin the physician may supply the necessary information and receive authorization from the health officer by telephone.

V. MASS COMMUNITY PROPHYLAXIS

Under exceptional circumstances additional supplies of gamma globulin may be allocated by the national authority for use in mass community prophylaxis. Requests for such use of gamma globulin will originate with full-time health officers in the local area after consultation with the local medical society and will be reviewed at the State and National levels.

Gamma globulin distribution

To secure supplies of gamma globulin for poliomyelitis prophylaxis physicians should contact the full-time health officer having jurisdiction. Following is a list of full-time health officers arranged alphabetically by city and county showing title, address, and telephone numbers:

County or city	Health officer	Title [1]	Address	Phone
Albany	John Powers, M. D	Comm	Room 203, City Hall, Albany	5-8894.
Allegany	Milton Tully, M. D	D. H. O	42 Broadway, Hornell	1038.
Binghamton	Elton R. Dickson, M. D	Health officer	Municipal Bldg., Binghamton	2-0216.
Broome—excluding Binghamton City	Daniel P. McMahon, M. D	D. H. O	116 State St., Binghamton	2-4237.
Bronx	See New York City			
Cattaraugus	Murray Grant, M. D	Comm	302 Laurens St., Olean	3181.
Cayuga	Walter C. Levy, M. D	D. H. O	316 S. Warren St., Syracuse 2	3-0166.
Chautauqua	T. Sylvia Miner, M. D	D. H. O	601 Hotel Jamestown Bldg., Jamestown	5-139.
Chemung	Milton Tully, M. D	D. H. O	42 Broadway, Hornell	1038.
Chenango	Daniel P. McMahon, M. D	D. H. O	116 State St., Binghamton	2-4237.
Clinton	Clayton M. Steward, M. D	D. H. O	Paul Smith Bldg., Saranac Lake	490.
Columbia	Raymond D. Fear, M. D	Acting Comm	363 Allen St., Hudson	8-3358.
Cortland	Joseph F. Rudmin, M. D	Comm	Courthouse, Cortland	1490.
Delaware	Michael Lipari, M. D	D. H. O	16 Dietz St., Oneonta	2586.
Dutchess—excluding Poughkeepsie City.	Raymond D. Fear, M. D	D. H. O	35 Market St., Poughkeepsie	129.
Erie	Berwyn F. Mattison, M. D	Comm	601 City Hall, Buffalo 2	MOhawk 2800.
Essex	Clayton M. Steward, M. D	D. H. O	Paul Smith Bldg., Saranac Lake	490.
Franklin	do	D. H. O	do	490.
Fulton	James J. Quinlivan, M. D	Acting D. H. O	18 South Market St., Johnstown	6-3189.
Genesee	Roger G. Knipe, M. D	D. H. O	127 North St., Batavia	1710.
Greene	Michael Lipari, M. D	D. H. O	16 Dietz St., Oneonta	2586.
Hamilton	Clayton M. Steward, M. D	D. H. O	Paul Smith Bldg., Saranac Lake	490.
Herkimer	Evelyn F. H. Rogers, M. D	D. H. O	18 Pearl St., Utica 2	2-5137.
Jefferson	Gordon R. Gray, M. D	D. H. O	113 Park Place, Watertown	6102.
Kings	See New York City			
Lewis	Gordon R. Gray, M. D	D. H. O	113 Park Place, Watertown	6102.
Livingston	Robert W. Bacorn, M. D	Acting D. H. O	510 Terminal Bldg., Rochester 4	Hamilton 7040.
Madison	Evelyn F. H. Rogers, M. D	D. H. O	18 Pearl St., Utica 2	2-5137.
Monroe—excluding Rochester City	Robert W. Bacorn, M. D	Acting D. H. O	510 Terminal Bldg., Rochester 4	Hamilton 7040.
Montgomery	James J. Quinlivan, M. D	Acting D. H. O	18 South Market St., Johnstown	6-3189.
Mount Vernon	Theodore A. Jost, M. D	Comm	City Hall Bldg., Mount Vernon	8-2200.
Nassau	Earle G. Brown, M. D	Comm	1053 Franklin Ave., Garden City	3-3000.
New Rochelle	Chester A. Hicks, M. D	Dir. Pub. Health	30 Church St., New Rochelle	2-2021.
New York City	John F. Mahoney, M. D	Comm	125 Worth St., New York 13	WOrth 2-6900.
New York County	See New York City			
Niagara Falls	Jerauld A. Campbell, M. D	Health officer	City Hall, Niagara Falls	7811.
Niagara—excluding Niagara Falls City	Roger G. Knipe, M. D	D. H. O	127 North St, Batavia	1710.
Oneida—excluding Utica City	Evelyn F. H. Rogers, M. D	D. H. O	18 Pearl St., Utica 2	2-5137.
Onondaga—excluding Syracuse City	Walter C. Levy, M. D	D. H. O	316 S. Warren St., Syracuse 2	3-0166.
Ontario	William R. Donovan, M. D	D. H. O	Geneva General Hospital, Geneva	8156.
Orange	John A. Degen, Jr., M. D	D. H. O	34 South St., Middletown	5087.

Orleans	Robert W. Bacorn, M. D	Acting D. H. O	510 Terminal Bldg., Rochester 4	Hamilton 7040.
Oswego	Walter C. Levy, M. D	D. H. O	316 S. Warren St., Syracuse 2	3-0166.
Otsego	Michael Lipari, M. D	D. H. O	16 Dietz St., Oneonta	2586.
Poughkeepsie	George Kraus, M. D	Health officer	24 Washington St., Poughkeepsie	10400.
Putnam	Raymond D. Fear, M. D	D. H. O	35 Market St., Poughkeepsie	129.
Queens	See New York City.			
Rensselaer	Frank E. Coughlin, M. D	Comm	Health Bldg., 7th and State Sts., Troy	AShley 2-2300.
Richmond	See New York City.			
Rochester	Albert D. Kaiser, M. D	Health officer	44 Marshall St., Rochester	Hamilton 0600.
Rockland	John A. Degen, Jr., M. D	D. H. O	34 South St., Middletown	5087.
St. Lawrence	Gordon R. Gray, M. D	D. H. O	113 Park Place, Watertown	6102.
Saratoga	Burke Diefendorf, M. D	D. H. O	11-17 South St., Glens Falls	2-0929.
Schenectady, City	Malcolm A. Bouton, M. D	Health officer	City Hall, Schenectady	4-3151.
Schenectady—excluding Schenectady City.	Malcolm A. Bouton, M. D.[2]	Health officer	do	4-3151.
Schoharie	Ward L. Oliver, M. D	Acting Comm	Schoharie	174.
Schuyler	William R. Donovan, M. D	D. H. O	Geneva General Hospital, Geneva	8156.
Seneca	William R. Donovan, M. D	Acting Comm	68 Fall St., Seneca Falls	1022.
Steuben	Milton Tully, M. D	D. H. O	42 Broadway, Hornell	1038.
Suffolk	Philip J. Rafle, M. D	Comm	246 Griffing Ave, Riverhead	3140.
Sullivan	John A. Degen, Jr., M. D	D. H. O	34 South St., Middletown	5087.
Syracuse	C. A. Sargent, M. D	Comm	City Hall, Syracuse	74-2751.
Tioga	Daniel P. McMahon, M. D	D. H. O	116 State St., Binghamton	2-4237.
Tompkins	Robert H. Broad, M. D	Comm	105 E. Seneca St., Ithaca	3454.
Ulster	Dudley Hargrave, M. D	Comm	15 Main St., Kingston	5200.
Utica	David E. Bigwood, Jr., M. D	Health officer	827 Union St., Utica 2	4-1141.
Warren	Burke Diefendorf, M. D	D. H. O	11-17 South St., Glens Falls	2-0929.
Washington	Burke Diefendorf, M. D	D. H. O	do	2-0929.
Wayne	Robert W. Bacorn, M. D	Acting, D. H. O	510 Terminal Bldg., Rochester 4	Hamilton 7040.
Westchester—excluding Mount Vernon, New Rochelle, and Yonkers.	William A. Holla, M. D	Comm	County Office Bldg., White Plains	9-1300.
Wyoming	Donald B. Thomas, M. D	Acting Comm	Wyoming County Community Hospital, Warsaw	338.
Yates	William R. Donovan, M. D	D. H. O	Geneva General Hospital, Geneva	8156.
Yonkers	Ralph F. Sykes, M. D	Comm	Health Center Bldg., Nepperham Ave., Yonkers	3-3980.

[1] Title: Comm.=Commissioner of health of a city or county; D. H. O.=District health officer.
[2] By arrangement with Johnstown district office.

NEW YORK STATE,
DEPARTMENT OF HEALTH,
Albany, May 18, 1953.

MP CD 53: 701.
Memorandum.
To: Regional health directors, district State health officers, city and county health commissioners.
From: Dr. Korns.
Subject: Use and distribution of gamma globulin for the prophylaxis of poliomyelitis, measles, hepatitis, and rubella.

Poliomyelitis

In view of the limited supply of gamma globulin available during this year's poliomyelitis season, the use is being limited to the circumstances specified in this memorandum. The latest available information indicates that not over 1 million average immunizing doses (7 million cubic centimeters) will be available this summer for poliomyelitis prophylaxis as outlined in the Plan for the Allocation of Gamma Globulin issued by the Office of Defense Mobilization, April 15, 1953, a copy of which was sent to you. Of this supply, 57 percent will be allocated to the various State health departments, 33 percent will be retained in the national pool for use in selected epidemic situations for mass community prophylaxis and 10 percent is being retained for special research projects.

The basic allocation in New York State has been computed as 60 cubic centimeters times the annual average number of cases reported during the 5-year period, 1947–51. This totals 158,280 cubic centimeters and may represent the only allocation. However, starting May 1 the State will receive at intervals additional gamma globulin in the amount of 60 cubic centimeters for each reported case in excess of the mean cumulative annual incidence (1947–51) for the same seasonal period. In view of the fact that the 5-year experience in New York State, upon which the basic allocation is calculated, includes at least 3 large epidemic years, it is rather unlikely that we shall exceed the average figure of 2,638 cases by an appreciable amount.

It is our understanding that the basic allotment to States, referred to above, represents only 20 percent of the total supply of the country. The balance between this amount and the 57 percent set aside for State health departments will be distributed as supplemental allocations at biweekly intervals beginning July 1. This represents a reservoir of gamma globulin available to take care of inequalities in poliomyelitis incidence this coming summer in the various States. In any event, it is planned to distribute all of this material by October 1.

Allocations from the national pool will be made for mass community prophylaxis under special circumstances, and full-time health officers who encounter situations in their jurisdictions appropriate for this type of prophylaxis should make application to the Bureau of Epidemiology and Communicable Disease Control who, in turn, will evaluate the circumstances and appeal to the National Allocating Authority for additional gamma globulin. In general, use of gamma globulin in this manner would be limited to communities of medium size, where a fairly high attack rate has been achieved and where the evidence suggests that the peak of the outbreak had not already been reached.

Allocation plan for New York State

1. Gamma globulin is not available for the therapy of poliomyelitis since it has been shown (1) to be of no value, even when given in heroic doses of 100 cubic centimeters per patient during the preparalytic period.

2. The prophylactic dose will be 0.14 cubic centimeters per pound of body weight, and because of the limited supply, the use of gamma globulin must be restricted to 1 dose per person per epidemic year. This dosage schedule was arrived at through careful studies in monkeys and through the field trials of Dr. Hammon, and represents the minimum effective dose. The latest report by Hammon (2) suggests that some degree of protection operates during the period 1 to 8 weeks after administration of gamma globulin. Although the disease was not prevented in the first week, it was favorably modified.

3. The diagnosis of poliomyelitis by the attending physician and his official report of the case on the C. D. 103 or C. D. 104 should ordinarily serve as justification for allocation of gamma globulin by the full-time health officer, for use in accordance with the limitations listed below. However, the health officer

should review the basis for the diagnosis with the attending physician and solicit information as to the clinical findings and spinal fluid examination. The health officer has the power to refuse to authorize the use of gamma globulin in circumstances where there is considerable doubt as to the diagnosis. This step should be taken only after careful review of the clinical and epidemiological circumstances, and with an eye on the limited supply of gamma globulin.

For your guidance, the diagnostic criteria adopted by the National Conference on Recommended Practices for the Control of Poliomyelitis are cited below:

"Diagnostic criteria of paralytic or nonparalytic poliomyelitis should generally include three or more of the following:

"(1) History compatible with poliomyelitis;

"(2) Fever;

"(3) Stiff neck and/or stiff back;

"(4) Ten to five hundred cells per cubic centimeters of spinal fluid taken during the acute or early convalescent period of the disease;

"(5) Spinal fluid protein elevated above normal limits;

"(6) Demonstrable muscle weakness or paralysis.

"Cases which present only (1) History compatible with poliomyelitis, and (2) fever, should be classified as presumptive (abortive) poliomyelitis.

"Paralytic cases are defined as those in which definite weakness or paralysis has been detected and persisted during at least two examinations made at intervals of at least several hours. Results of an examination for paralysis of muscles of the extremities or trunk may be very unreliable during the period of muscle tenderness or 'spasm'."

4. (*a*) Priority shall be given to the use of gamma globulin in household contacts. This group will be limited to individuals under 30 years of age, except that pregnant women of any age will be candidates for prophylaxis. A household contact is defined as any person living continuously in the same household as the index case or any person who has lived within this household for at least 24 hours during the period of communicability of this case. The term "household" as used is not meant to include other families living in a multiple-dwelling unit. Effective contact is defined as "direct physical contact with the index case," during the communicable stage of the disease which has been limited, by definition, to 3 days before to 7 days after onset of illness. In order for an individual to qualify as a candidate for gamma globulin, this contact must have occurred at some time during the preceding 12 days.

(*b*) Secondary consideration will be given to nonhousehold contacts whose exposure to the index case fulfills the criteria for "effective contact" under paragraph (4 (*a*)). Use of gamma globulin for nonhousehold contacts will be limited to individuals under 21 years of age, pregnant women of all ages and nurses caring for poliomyelitis patients in the communicable stage.

Obviously, great pressure will be put upon the health officer to release gamma globulin for large numbers of nonhousehold contacts. In order to conserve the supply for use in the most productive fashion, he should carefully evaluate the circumstances surrounding each request, and use cautious judgment in deciding about allocation. The Bureau of Epidemiology and Communicable Disease Control is available for consultation in those matters. The health officer should bear in mind that the allocation of gamma globulin to New York State is geared to an average of 60 cubic centimeters per reported case. In some instances, the amount allocated by him to the contacts of a given case may far exceed this; however, the average allocation should not exceed 60 cubic centimeters per case.

Whenever modified mass prophylaxis is considered, as for example, when poliomyelitis occurs in summer camps, institutions, schools and the like, consultation should be sought with the Bureau of Epidemiology and Communicable Disease Control. Under ordinary circumstances in camps, the use of gamma globulin will be restricted to the immediate bunk mates of the index case and somewhat similar localization will be attempted in school and institutional situations. However, each episode must be considered individually on its own merits, bearing in mind the amount of gamma globulin available at the time. The upstate New York experience of 1949 should be recalled, when poliomyelitis occurred in 69 camps. In 47 of these, only a single case occurred; in 9, 2 cases, in 4, 3 cases, in 1, 4 cases, in 3, 5 cases, in 3, 6 cases, in 1, 7 cases, and in 1, 10 cases. Unfortunately, it is impossible to select in advance those camps destined to have further trouble.

5. The mechanics for distribution of gamma globulin are described in detail in the Office Manual, Communicable Disease, Item 17 a.–c. In brief, the attending physician must apply to the full-time health officer for gamma globulin, furnishing all of the information requested on form C. D. 318, which will be completed by the health officer or someone in his office. If satisfied that the request is appropriate, an authorization number will be given the physician, consising of a code number and the number of vials of gamma globulin authorized. For example, if the first issuance is to be for 5 vials, the authorization number will be P1–5; if the second authorization is for four vials, the authorization number will be P2–4, etc. The full-time health officer or his designated representative should be available to the attending physician at all times for the issuance of such authorization.

A running inventory of the amounts of gamma globulin authorized for distribution and the supplies maintained at the laboratory supply stations will be kept by the health officer on form C. D. 319. The details as to how this is to be accomplished are described in the Office Manual, Communicable Disease, 17 c.

6. Gamma globulin will be stocked in those supply stations designated by the health officer. It is urged, however, that this list of supply stations be examined critically during the course of the coming months, with a view to making changes in keeping with the poliomyelitis incidence in various areas.

It is planned to distribute to supply stations approximately one-third of the gamma globulin anticipated to be needed on the basis of the 5-year experience, 1947–51, as calculated for individual counties and major cities (see attached tabulation). The balance will be held in reserve in the division of laboratories and research and will be distributed as need develops, when the initial shipment is utilized in accordance with the proposed plan. However, only 7 percent of the anticipated supply of gamma globulin has been shipped to New York State. Thus, the initial distribution will be meager indeed and, of necessity, will have to be confined to certain major supply stations. Until this shortage is overcome in the near future, your requests for gamma globulin in poliomyelitis prophylaxis should be addressed to the division of laboratories and research in the event that shipments to designated supply stations in your area have been delayed.

7. Gamma globulin will be packaged in 10 cubic centimeter ampules for poliomyelitis prophylaxis. This would seem to be a wasteful practice but, nevertheless, is the decision of the National Allocating Authority. Ampules of 1 and 2 cubic centimeters will be utilized for measles, German measles and hepatitis prophylaxis. As of the present, these smaller ampules carry the statement on them that they are not for use in poliomyelitis prophylaxis. Later on, possiblly not before next year, the smaller ampules will also be satisfactory for poliomyelitis prophylaxis and will carry a statement to that effect. However, at present, it can be stated that the level of poliomyelitis antibodies in the smaller ampules is not accurately known. Hence, this material may be of little value in preventing poliomyelitis.

8. In the absence of sufficient gamma globulin for poliomyelitis prophylaxis, it is not recommended that whole blood or plasma be utilized. This opinion is shared by the important investigators in this field. In order to achieve adequate levels of poliomyelitis antibody, one liter or more of blood would have to be administered. In addition to the hazards associated with blood or plasma transfusions, one must bear in mind that the donor selected might have relatively little poliomyelitis antibody, particularly against the strain of virus present in the community. Attending physicians, of course, may see fit to utilize this procedure in their patients, but there is little scientific justification for it.

9. Studies are contemplated to evaluate the phophylactic benefit derived from the use of gamma globulin in household contacts. Information derived from form C. D. 318, as well as a modified form C. D. 316 (to be revised) will furnish the basic information. Details concerning this study will be furnished you early in June.

10. The National Allocating Authority is faced with the problem of distributing the supply of gamma globulin equitably among the various States. For this purpose they will want to know the proportion of reported cases which are paralytic and would like to receive current information on the number of deaths from poliomyelitis in each State. Information of this sort can hardly be obtained with accuracy at the time of onset of illness. However, physicians should be

encouraged to record on the case report their best judgment as to whether the case is paralytic or nonparalytic, and if the patient has died before the report is made, so indicate on the face of the report, with the date of death. These data, although inaccurate, will be transmitted in the weekly report to the National Office of Vital Statistics, who in turn, will make them available to the National Allocating Authority for their information. Supplemental investigation later with the completion of form C. D. 316 will serve to correct erroneous initial impressions.

11. Health officers may be questioned about the role of parenteral injections in either increasing the hazard or localizing the paralysis in poliomyelitis, and the relationship of injections of gamma globulin to this hazard. It should, therefore, be stated that the recommendations of this department, urging the postponement of elective injections in persons over 6 months of age, in areas where poliomyelitis is unusually prevalent, are still valid. According to the published evidence (2), injection of gamma globulin in persons exposed to epidemics of poliomyelitis does not demonstrate this phenomenon.

Measles

Gamma globulin for the phophylaxis of measles, rubella and infectious hepatitis has been made available by the National Allocating Authority on the basis of 3 cubic centimeters times the number of cases represented by the 5-year median for measles (1947–51). The incidence of measles will be reviewed at monthly intervals and supplemental allocations may be made on the basis of unusual measles morbidity. The total allocation to New York State for this purpose is 118,700 cubic centimeters.

The criteria for distribution in the prophylaxis of measles will be continued according to the pattern in practice for several years. It will be available for either modification (0.02 cc. per pound of body weight) or for prevention (0.1 cc. per pound of body weight) in children under 4 years of age and debilitated children of all ages where this procedure is medically justified. The only change in procedure is the necessity for authorization by the full-time health officer of the physician's request for gamma globulin for this purpose. The reverse side of form CD 318 must be completed by the health officer with information supplied by the attending physician and an authorization number furnished, as in poliomyelitis, except that the prefix "X" instead of "P" will be substituted. Reference is made again to the Office Manual, Communicable Disease, Item 17, which presents the details for this procedure and the maintenance of the inventory form, CD 319. It is urged that physicians utilize by preference the dosage for modification instead of prevention, in order both to conserve the supply and to allow the patient to achieve permanent immunity.

This plan of distribution seems feasible, since the year 1953 will be one of low measles incidence in New York State, particularly during the months of the poliomyelitis season. It is contemplated that this modified procedure will revert to the old practice of distribution by laboratory supply stations without special authorization of health officers at the termination of the poliomyelitis season. At that time, the periodic seasonal epidemic of measles will again appear, and the administrative burden of authorizing its use by the health officer would seem to be unnecessary, in the absence of a serious poliomyelitis problem.

Rubella (German measles)

Although the use of gamma globulin in the prevention of rubella is not specifically mentioned in the Federal plan of allocation, we have been assured by the Allocating Authority that it is within the province of State health departments to utilize gamma globulin for this purpose if they see fit. We have, therefore, decided to make it available for prophylaxis in women who are in the first trimester of pregnancy and who have been exposed to rubella. The recommended dosage is 0.1 cubic centimeter per pound of body weight, with a maximum of 12 cubic centimeters, preferably containing material from at least 2 separate lots. Authorization of the health officer will be required as for measles, and pertinent information concerning the source case and the status of pregnancy in the patient will be required on form CD 318. The scientific basis for the use of gamma globulin in this manner stems from studies by this department (3), which clearly indicate a significant prophylactic value. It should be pointed out, however, that studies in Australia (4), utilizing gamma globulin prepared from convalescent rubella serum and administered to human volunteers, artificially

infected with rubella virus, failed to prevent the disease. Further studies of this problem are needed. However, it is difficult to disregard the positive experience of this department, which actually represents a closer approximation to the field situation met in practice.

Infectious hepatitis

Gamma globulin is distributed for prophylaxis in household contacts of reported cases of infectious hepatitis, without restrictions as to age. However, its use has been limited to persons who have had direct physical contact with the patient during the communicable stage and at sometime during the previous 20 days. The dosage will be 0.01 cubic centimeter per pound of body weight. Thus the average adult will receive from 1 to 2 cubic centimeters. This small quantity has been found to be very effective in preventing the disease while, at the same time, an active immunity develops in those harboring the virus without any evidence of clinical illness (5). This immunity is known to last for at least 9 months and probably indefinitely. It should be recalled that gamma globulin is of no value in preventing homologous serum jaundice.

The use of gamma globulin in the prophylaxis of infectious hepatitis in nonhousehold contacts will be allowed only under special circumstances, authorized by the health officer with due regard for the limited supply. Whenever prophylaxis is contemplated on a mass basis, as for example in camps, institutions, schools, or hospital populations, prior authorization will be needed from the Bureau of Epidemiology and Communicable Disease Control.

Studies are contemplated for the purpose of evaluating the prophylactice benefits derived from the use of gamma globulin in household contacts of reported cases. A modified form C. D. 144 (to be revised) will be obtained on all reported cases. Details of this study will be issued later.

The procedure for authorizing designated laboratory supply stations to release gamma globulin to the attending physician for this purpose is similar to that described for measles, and is described in detail in the Office Manual, Communicable Diseases, item 17.

R. F. K.

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Poliomyelitis experience, 1947–51, upstate New York, by full-time health jurisdiction with estimated allocation of gamma globulin

Health jurisdiction	Reported cases poliomyelitis						Estimated allocation (cubic centimeters)	Initial allocation (cubic centimeters)	Number of 10-cubic centimeter vials
	1947	1948	1949	1950	1951	5-year average			
Albany region:									
Schenectady City Health Department	2	13	11	29	16	14	840	280	28
Albany County Health Department	22	4	59	55	26	33	1,980	660	66
Columbia County Health Department	1	1	27	2	4	7	420	140	14
Rensselaer County Health Department	14	------	37	29	10	18	1,080	360	36
Schoharie County Health Department	------	2	14	10	1	5	300	100	10
Glens Falls District Health Office	9	5	269	93	42	84	5,040	1,680	168
Saratoga County	9	4	38	23	9	17	1,020	340	34
Warren County	------	1	95	20	11	25	1,500	500	50
Washington County	------	------	136	50	22	42	2,520	840	84
Johnstown District Health Office	9	21	22	77	31	32	1,920	640	64
Fulton County	------	3	4	23	9	8	480	160	16
Montgomery County	2	3	7	32	5	10	600	200	20
Schenectady County	7	15	11	22	17	14	840	280	28
Oneonta District Health Office	26	10	103	82	31	50	3,000	1,000	100
Delaware County	9	------	53	27	7	19	1,140	380	38
Greene County	10	5	36	5	6	12	720	240	24
Otsego County	7	5	14	50	18	19	1,140	380	38
Saranac Lake District Health Office	17	8	36	18	52	26	1,560	520	52
Clinton County	11	4	17	7	10	10	600	200	20
Essex County	4	3	9	3	38	11	660	220	22
Franklin County	2	1	10	7	2	4	240	80	8
Hamilton County	------	------	------	1	2	1	60	20	2
Buffalo region:									
Niagara Falls City Health Department	3	4	12	19	6	9	540	180	18
Cattaraugus County Health Department	11	6	85	18	8	26	1,560	520	52
Erie County Health Department	76	32	351	155	94	142	8,520	2,840	284
Wyoming County Health Department	3	1	11	14	3	6	360	120	12
Batavia District Health Office	9	2	53	33	17	23	1,380	460	46
Genesee County	2	------	15	6	3	5	300	100	10
Niagara County	7	2	38	27	14	18	1,080	360	36
Jamestown District Health Office: Chautauqua	70	16	22	45	11	35	2,100	700	70
Rochester region:									
Rochester City Health Department	87	15	58	105	16	56	3,360	1,120	112
Seneca County Health Department	7	2	25	9	6	10	600	200	20
Geneva District Health Office	8	1	12	26	7	11	660	220	22
Ontario County	7	------	2	13	6	6	360	120	12
Schuyler County	------	------	2	7	1	2	120	40	4
Yates County	1	1	8	6	------	3	180	60	6
Hornell District Health Office	54	20	49	30	8	34	2,040	680	68
Allegany County	7	2	25	4	3	8	480	160	16
Chemung County	13	10	4	20	2	10	600	200	20
Steuben County	34	8	20	15	3	16	960	320	32

Poliomyelitis experience, 1947–51, upstate New York, by full-time health jurisdiction with estimated allocation of gamma globulin—Continued

Health jurisdiction	Reported cases poliomyelitis						Estimated allocation (cubic centimeters)	Initial allocation (cubic centimeters)	Number of 10-cubic centimeter vials
	1947	1948	1949	1950	1951	5-year average			
Rochester region—Continued									
Rochester District Health Office	68	14	40	108	17	49	2,940	980	98
Livingston County	11	1	7	8	3	6	360	120	12
Monroe County	37	8	21	85	9	32	1,920	640	64
Orleans County	12	4	7	.....	1	5	300	100	10
Wayne County	8	1	5	15	4	6	360	120	12
Syracuse region:									
Binghamton City Health Department	59	9	27	34	11	28	1,680	560	56
Syracuse City Health Department	46	14	24	152	23	52	3,120	1,040	104
Utica City Health Department	5	3	4	68	4	17	1,020	340	34
Cortland County Health Department	9	4	3	15	2	7	420	140	14
Tompkins County Health Department	24	28	6	11	2	14	840	280	28
Binghamton District Health Office	68	29	47	77	30	50	3,000	1,000	100
Broome County	44	19	33	34	21	30	1,800	600	60
Chenango County	22	8	12	37	6	17	1,020	340	34
Tioga County	2	2	2	6	3	3	180	60	6
Syracuse District Health Office	46	39	46	203	60	79	4,740	1,580	158
Cayuga County	15	7	14	30	10	15	900	300	30
Onondaga County	27	21	30	80	25	37	2,220	740	74
Oswego County	4	11	2	93	25	27	1,620	540	54
Utica District Health Office	9	6	38	218	30	60	3,600	1,200	120
Herkimer County	4	1	11	75	9	20	1,200	400	40
Madison County	5	4	14	38	7	14	840	280	28
Oneida County	.....	1	13	105	14	26	1,560	520	52
Watertown District	32	15	38	285	44	83	4,980	1,660	166
Jefferson County	18	9	11	182	11	46	2,760	920	92
Lewis County	3	2	3	73	9	18	1,080	360	36
St. Lawrence County	11	4	24	30	24	19	1,140	380	38
White Plains region:									
Mount Vernon City Health Department	5	2	17	12	6	8	480	160	16
New Rochelle City Health Department	.....	13	31	18	23	17	1,020	340	34
Poughkeepsie City Health Department	2	.....	39	4	2	9	540	180	18
Yonkers City Health Department	14	22	36	48	28	30	1,800	600	60
Nassau County Health Department	23	100	435	308	173	208	12,480	4,160	416
Suffolk County Health Department	41	50	256	266	75	139	8,340	2,780	278
Ulster County Health Department	.....	15	46	18	15	19	1,140	380	38
Westchester County Health Department	22	76	125	165	66	91	5,460	1,820	182
Middletown District Health Office	9	44	73	95	21	48	2,880	960	96
Orange County	3	7	41	53	9	22	1,320	440	44
Rockland County	4	8	13	29	9	13	780	260	26
Sullivan County	2	29	19	13	3	13	780	260	26
Poughkeepsie District Health Office	3	14	43	16	15	18	1,080	360	36
Dutchess County	3	11	41	12	11	15	900	300	30
Putnam County	.....	3	2	4	4	3	180	60	6
New York City	214	676	2,446	1,064	553	991	59,460	19,820	1,982

NEW YORK STATE DEPARTMENT OF HEALTH,
BUREAU OF EPIDEMIOLOGY AND COMMUNICABLE DISEASE CONTROL,
August 7, 1953.

Supplement to MP CD 53 : 701.
To : Regional health officers, district State health officers, city and county health commissioners.
From : Dr. Korns.
Subject : Use and distribution of gamma globulin for the prophylaxis of poliomyelitis, measles, hepatitis, and rubelle.

Poliomyelitis

Supplementing paragraph 4b on page 3, use of gamma globulin for nurses will be limited to those under 30 years of age who have had direct personal contact with poliomyelitis patients in the communicable stage of the disease.

Paragraph 5, page 4, is amended to describe the authorization number in terms of cubic centimeters of gamma globulin allocated instead of number of vials.

Paragraph 7 of the same page is amended to indicate that most of the basic allocation of poliomyelitis gamma globulin is packaged in 2 cubic centimeters ampules. Similarly, the gamma globulin used for measles, German measles, and hepatitis is packaged in 2 cubic centimeters ampules.

Paragraph 9, page 5, should be expanded to call attention to the poliomyelitis study plan outlined in a separate memorandum using the modified form CD 316 to be completed for each case of poliomyelitis with onset after June 1, 1953. Current cases are to be investigated at some time between 2 and 4 weeks after the onset of symptoms. Form CD 318 for cases of poliomyelitis is to be filled out in duplicate, one copy retained in the issuing office to assist in the preparation of form CD 316, the other copy to be sent immediately after completion to the Bureau of Epidemiology and Communicable Disease Control.

Infectious hepatitis

Statement on page 7 should be modified to request completion of form CD 318 in duplicate in connection with the allocation of gamma globulin to the contacts of cases of infectious hepatitis, one copy to be retained in the issuing office for use in completion of form CD 144A, the other copy to be sent immediately after completion to the Bureau of Epidemiology and Communicable Disease Control. The outline of the study designed to evaluate the use of gamma globulin in household contacts of cases of infectious hepatitis is presented in a separate memorandum, Form CD 144, entitled "Homologous Serum Jaundice, Supplemental Report," remains unchanged and should continue to be completed for reported cases of serum hepatitis.

R. F. K.

Endorsed :

V. A. VAN VOLKENBURGH, M. D.

AUGUST 7, 1953.

Memorandum.
To : Regional health directors, county health commissioners, district health officers, and city health officers.
From : Dr. Korns, C. D. Bureau.
Subject : Comment on poliomyelitis gamma globulin distribution plan.

The plan for gamma globulin distribution in the prophylaxis of poliomyelitis which became effective May 15, despite some difficulties, has functioned remarkably well thus far in most parts of the State. It is not proposed to change it at this time, however, attention should be called to the exact wording of one portion of the plan as it was distributed to all physicians in the State. In the paragraph concerning nonhousehold contacts the following statement appears "within the 60 cubic centimeters average allotment per case, the health officer may provide gamma globulin for administration to persons not members of the patient's household." Since great difficulties have arisen in certain areas, particularly the metropolitan counties, concerning the definition of nonhousehold contacts and the decision as to how many of those so labeled deserve gamma globulin, it is deemed wise to make clear that the allocation of gamma globulin for use in nonhousehold contacts is a permissive matter and that the county, city, or district health officer administering the program has the authority to limits its distribution. Thus, certain counties have found it necessary to categorically exclude nonhousehold contacts from the program. It would seem, however, that before adopting such a rigid rule the health officer should assure himself that

the program being carried out in his area is making use of a large portion or the entire amount of 60 milliliters per reported case.

In this connection, it is interesting to review the information available in this office on how health officers have been allocating gamma globulin to date. Actually, from the forms CD 318 available here (135) an average of only 41 milliliters gamma globulin has been used per case, 32 milliliters for household contacts, and 9 milliliters for nonhousehold contacts. This, of course, may not be a fair sample of the entire State's experience. One additional point of interest with direct bearing on the value of the program is the observation that 75 percent of the contacts given gamma globulin received it within 5 days after the onset of the index case.

Approximately one-third of the basic allocation of 158,280 milliliters gamma globulin to New York State has been distributed to supply stations. It will be recalled that the national plan contemplated issuing supplemental allocations of gamma globulin to the States at biweekly intervals starting July 1, and consisting of 60 milliliters for each reported case in excess of the 5-year average 1947–51. Since, as of the present time, New York State has had reported over four times as much poliomyelitis this year as the average of this 5-year experience, we are due for a sizable supplemental allocation. Inquiry at Washington, however, indicates that the national supply is exhausted at the moment and that supplemental allocations may not be issued until mid-September. The problem is one of slowness in processing gamma globulin for distribution. The original goal of 7 million milliliters or 1 million doses may be achieved by the end of the year, but much of this may not be available until the end of the poliomyelitis season. Despite this fact, however, it does not seem necessary to change the program in New York State and we probably will not run out of material before supplemental supplies become available.

Another issue raised by several health officers concerns the allocation of material by one health officer for individuals who are residents of other counties or other States. In the metropolitan areas, around New York City, this same question applies to the many New York City residents who are exposed to poliomyelitis in upstate areas. The health officers concerned have always expressed hesitancy in allocating gamma globulin for use in such individuals, be they household or nonhousehold contacts, since it was their impression that predetermined amounts of gamma globulin were being parceled out to each county based on past poliomyelitis experience, and that when this supply was exhausted the particular county would receive no more. Actually, in practice, the entire State, including New York City is considered as a unit and gamma globulin is distributed to supply stations as the need develops and is expressed by the local area. It is our belief that all the allocating health officers are closely following the basic plan and, therefore, the gamma globulin distributed is being properly utilized. Thus, the only concern the allocating health officer need have is to establish to his satisfaction that the index case is a bona fide case of poliomyelitis and that the contacts involved meet the specifications of the plan. In other words, the health officer in whose jurisdiction the case of poliomyelitis occurs should be the one primarily involved in allocating gamma globulin. This will help to avoid the dilemma where several health officers allocate for the contacts of a single case, thus, in combination, distributing far more than the average of 60 milliliters. There are, of course, other problems associated with bookkeeping and exchange between adjacent health departments which can best be settled at the local level as they arise.

One other feature of the program needs additional comment. The plan allows for the giving of gamma globulin to nurses who are in direct physical contact with a case during the communicable stage and as presently worded does not define an upper-age limitation. It has been decided to limit this arbitrarily to nurses under 30 years of age, in keeping with the limitation applied to household contacts. This seems eminently justified because of the low attack rate in older age groups. It should be mentioned that in certain areas, particularly New York City, it has been found necessary to exclude nurses entirely as recipients of gamma globulin, since it was felt that giving it to a few nurses would necessitate giving it to thousands which would easily dissipate the entire supply of gamma globulin for a small benefit.

The only other point that needs to be mentioned at this time concern the completion of the form CD 316 which has been revised and is distributed with a separate memorandum discussing the evaluation studies of gamma globulin prophylaxis in poliomyelitis and hepatitis.

NEW YORK STATE DEPARTMENT OF HEALTH,
Albany, August 10, 1953.

Memorandum

To: Regional health directors, county and city health commissioners, and district State health officers.

From: Dr. Korns.

Subject: Field studies to evaluate the effectiveness of gamma globulin in the control of poliomyelitis and infectious hepatitis.

Poliomyelitis

A. *Study of households with more than one case of poliomyelitis.*—In the search for a technique to evaluate the prophylactic effectiveness of gamma globulin administered to household contacts of index poliomyelitis cases, a committee of nationally recognized authorities met in Atlanta last spring under the sponsorship of the United States Public Health Service. One of the suggested study plans, aimed at determining the secondary attack rate from poliomyelitis in families of index cases receiving gamma globulin as compared to families not receiving gamma globulin, was discarded as impossible to achieve satisfactorily. It was estimated that a sample of 15,000 index cases with some 40,000 household contacts would be needed to demonstrate a statistically significant effect on the secondary attack rate, and that even though such a large sample were studied it would be hazardous to compare this experience with the secondary attack rate in previous years in other areas. For that matter, the comparison of such rates with those in families with a 1953 index case, but not receiving gamma globulin, would be subject to error since the two groups of families would not be comparable. Furthermore it was assumed that there would be relatively few families this summer in which a case occurred where gamma globulin was not administered to household contacts.

Thus a second approach to evaluation, aimed at measuring modification rather than prevention was devised and constitutes the study plan presented here. This involves the comparison of the extent of paralysis in cases of poliomyelitis occurring in multiple-case households. Those patients coming down with their illness during the period between the onset of the index case and the date of gamma globulin administration, and referred to as group I, would be compared with those patients developing symptoms during the week following administration of gamma globulin (group II). If the program were successful, an appreciable diminution in the extent of paralysis might be demonstrated in group II as compared to group I. The evidence available to the committee suggested that under normal circumstances without gamma globulin multiple cases in families, occurring at various intervals after the onset of the index case, did not differ particularly in average severity. This is still a weak point in the proposed study and will need to be assessed further in the final analysis.

The Communicable Disease Center of the United States Public Health Service, acting upon the recommendation of this committee, has devised a study along these lines to include all multiple case families discovered in the United States this year. An initial investigation of these families will be carried out by epidemiologists assigned to the various State health departments from the Communicable Disease Center. These visits are to be scheduled during the period 7 to 14 days after onset of the index case, and are for the purpose of verifying the diagnoses and obtaining exact information concerning dates of onset and dates of gamma globulin administration, if any was given. Subsequent secondary cases discovered through the case reporting mechanism would be reviewed in similar manner. At an interval of 50 to 70 days after onset of each case a physical therapist will examine all patients in these families in a uniform fashion so as to obtain an accurate measurement of the extent of residual paralysis. Three State employed physical therapists participated several weeks ago in a course sponsored by the United States Public Health Service, at Pittsburgh, devoted to the indoctrination of these muscle graders in a uniform and simplified technique. One may criticize the design of the study, but it is perhaps the best possible under the circumstances.

The above study makes no demands on the time of other State or local health department personnel. The only responsibility which falls on the shoulders of county, city, and district health officer is the discovery of multiple-case families. These, of course, will come automatically to his attention through case reports or requests for gamma globulin, and will be passed on in due time to the Bureau of Epidemiology and Communicable Disease Control. There may, however, be a

considerable delay in receiving this information in Albany and it will be appreciated if the health officers concerned will notify this Bureau by memorandum of such instances, giving details as to names of patients, exact home address, and name and address of the hospital in order to expedite the investigation by the epidemiologist. These need not necessarily be individuals with the same name since persons living at the same address may bear different names. We leave to the ingenuity of each health officer the job of devising a system to discover multiple-case families among the reports sent through his office.

Since, in the New York State experience, about 70 percent of the so-called secondary cases (perhaps they should be called coprimary cases) occur within the first week after the onset of the index case, the bulk of these multiple-case families will be evident at the time the physician requests gamma globulin. In this study we are referring only to clinical cases of poliomyelitis which the attending physician deems it proper to report. We are not referring to the great multitude of minor illnesses in families with an index case, which may or may not be due to infection with the polimyelitis virus, and which the physician would ordinarily not report as poliomyelitis.

In summary, therefore, the only responsibility that city, county, and district health officers need play in this study is to keep informed of multiple-case families and notify this Bureau expeditiously. Earlier it was estimated that there would be not over 75 such multiple-case families in New York State and that there would be about 1,500 in the entire country. Thus far, in the Steuben-Chemung County focus, a total of 16 multiple-case families have been uncovered and investigated along these lines. Dr. Ernest Kane, epidemic intelligence officer from the Communicable Disease Center, assigned to this bureau, will be carrying on these studies and will keep in touch with the health officers concerned.

B. *Routine investigation of all reported cases of poliomyelitis with form CD 316.*—The advisory committee meeting in Atlanta discussed the possibility of promoting additional joint studies in poliomyelitis involving the participation of a number of States, allowing the accumulation of information on a larger number of cases and household members. Since many State health departments routinely visit each case of poliomyelitis and obtain certain basic clinical and epidemiological information, the development of a uniform questionnaire to be used widely was deemed to be feasible and worthwhile. It is our understanding that at least 12 of the larger States are participating in this project.

The revised form CD 316, a copy of which is attached with the instruction sheet for the investigator, is an abbreviated and simplified version of the form suggested by the Federal group. The primary points under investigation include the role of genetic factors, menstruation, and pregnancy in susceptibility to poliomyelitis. In addition, several other more fully established accessory factors, such as tonsillectomy, dental extraction, parenteral injections, etc., are also included. The form is devised so that the public health nurse may readily complete it. It is requested that this be done sometime during the period 2 to 4 weeks after onset of the index case. The instruction sheet which should be made available to each investigating nurse, discusses the purpose and method of answering all items about which there may be questions.

These forms have already been completed on all 138 cases of poliomyelitis in Steuben and Chemung Counties and do not seem to represent an undue burden or a difficult procedure. We appreciate that since June 1, some 258 cases throughout upstate New York, exclusive of Steuben and Chemung Counties, have had onset; however, only 101 of these had onset over 1 month ago and thus represent the actual backlog, which should not place a major burden on any one area. The delay in issuing the new form CD 316, was brought about by difficulties concerned with the development of the national plan. Certain health officers have made some use of the old form CD 316 and we would appreciate their starting anew with the revised form.

Infectious hepatitis

Although the effectiveness of gamma globulin in preventing infectious hepatitis has been clearly demonstrated in the controlled studies within schools and institutions, the value of this material in preventing secondary cases in households has yet to be demonstrated. True enough, our administrative program is centered around use of gamma globulin in household contacts of index cases, and the decision to allocate it in this manner was made after careful thought and with the advice of national authorities. However, it is very important that the value of this program be assessed so that we may know at the end of the year, or by next year, whether this technique is accomplishing any good in terms

of preventing infectious hepatitis or whether some other approach to control is preferable, (e. g. the mass use of gamma globulin in school populations when the disease appears).

The evaluation of this effect is attempted through the completion of the form CD 144A, a copy of which is attached with the instruction sheet. It is requested that this form be completed for all reported cases of infectious hepatitis with onset after June 1, when gamma globulin became available for prophylaxis. The hope is that in only a portion of the reported cases will the household associates have received gamma globulin, and it will then be possible to compare the secondary attack rate in families receiving this product with those families where it was not administered. In order to study properly the comparability of families in each of these two groups, a number of other questions are inserted in the form which may at first seem irrelevant, particularly those on the environmental sanitation and structure of the dwelling unit, as well as whether the household member is a veteran or not.

The investigation is to be completed 6 weeks after the onset of the index case. The reason for delay until this period is to allow time for the development of the great majority of secondary cases. Review of upstate New York experience in recent years indicates that 87 percent of the so-called secondary cases occur within 6 weeks after onset of the index case. Delay in visiting the family until then may cause loss of detail and accuracy in certain questions but, on the other hand, some of these details may be obtained from the form CD 318 completed at the time gamma globulin was allocated, or from the initial case report card.

Cases of infectious hepatitis occurring in institutional populations such as State hospitals or, for that matter, any situation that does not represent the experience of hepatitis in a household, need not be investigated in this manner since, obviously, such cases would not assist in answering the question proposed. A review of the cases in your area with onset since June 1 and more than 6 weeks ago, will reassure you that the number of investigations to be completed immediately is not large. It is contemplated that the public health nurse will be the primary investigator. Another reassuring thought to the health officer, who feels that this request to participate in this investigation is an imposition at this time, is the knowledge that infectious hepatitis customarily follows a seasonal pattern quite different from poliomyelitis, having a peak in the spring and late fall but a low point during the summer.

R. F. K.

INVESTIGATOR'S INSTRUCTIONS FOR COMPLETING CD 316

This investigation is part of a larger study of similar nature being conducted in many other States this summer under the sponsorship of the United States Public Health Service. The findings in New York State will be made part of the total study. The form is to be completed for all cases of poliomyelitis with onset since June 1, 1953. On current cases it is suggested that the form be completed sometime between 2 and 4 weeks after the onset of the index case.

Date of onset.—Defined as the date of onset of any contagious illness leading to the signs and symptoms of central nervous system involvement which is subsequently diagnosed as poliomyelitis.

Spinal tap.—Merely indicate whether such a tap was performed. If it is deemed essential to obtain the details as to the results of this examination, later special followup through attending physician or hospital will be carried out.

Diagnosis and extent of paralysis.—The answers to these questions should be the best, readily available to the investigator (nurse, PT, epidemiologist, etc.). If later it seems essential to obtain further detail on the extent of paralysis, a special review of the muscle-grading records on file in county and city health departments, and district health offices will be undertaken as a separate project.

The questions on blood relationship between parents (examples: First cousins, second cousins) and twins in the household are asked for the purpose of studying the role of genetic factors in susceptibility to poliomyelitis. If suggestive leads are uncovered further detailed study will be undertaken by the Bureau of Epidemiology and Communicable Disease Control. Both twins need not be present in the household in order to be so labeled. Name and address of nonresident twins should be included on form.

On the household roster.—Note that person No. 1 is the index case. Secondary or other current cases in the family are to be checked in the second column and will be the subject of special study by the Bureau of Epidemiology and Communicable Disease Control. A household as defined here includes all persons who occupy a dwelling unit. Lodgers, regularly employed servants, etc., are considered household members.

Relation to index case.—Father, wife, son, brother, sister, etc.

Age.—Refers to age at last birthday; if under 1 year specify months.

Throat, mouth, other operations.—Should include tonsillectomy, adenoidectomy, tooth extractions, etc., and any other operations performed during the month prior to onset of the index case.

All injections.—Include immunizations, skin tests, therapeutic injections, but excludes gamma globulin injection which is entered in the last column.

The date of last menstrual period is of interest because of published evidence that susceptibility to poliomyelitis is greater at certain periods in the menstrual cycle. These observations need to be verified and expanded. The date asked for is the day menses commenced, in the last period before onset of the index case. If this date cannot be recalled, the date of the onset of the succeeding period should be used.

NEW YORK STATE DEPARTMENT OF HEALTH

POLIOMYELITIS SUPPLEMENTAL REPORT

Name of patient _____ Age ____ Color ____ Occupation _____

Home address _____ City / Village / Town _____ County _____
Street and Number

Date of onset _____ Hospitalized Yes ☐ No ☐

Attending physician _____ Address _____
Name

Hospital name and address: 1 _____ Date admitted _____ Date discharged _____

2 _____ Date admitted _____ Date discharged _____

Was spinal tap performed? Yes ☐ No ☐ Unknown ☐

Diagnosis: Nonparalytic ☐ Paralytic ☐ Disagnosis questionable ☐

Extent of Paralysis:[1]

Bulbar ☐ Trunk ☐ Other (specify) ☐
Arm, right ☐ Leg, right ☐
Arm, left ☐ Leg, left ☐

Died: Yes ☐ No ☐ Date _____

Source of information on diagnosis and paralysis:

Attending physician ☐ Hospital record ☐
Mother or patient ☐ Physical therapist grading ☐
Other ☐

Are the parents of patient related by blood in any manner? Yes ☐ No ☐

If yes, state relationship _____

If any of household members are twins identify by "person number" as listed on reverse: _____ and _____ (if one twin not present in household, give name and address below).

Are they Identical twins ☐ Fraternal twins ☐ Not specified ☐

Remarks _____

[1] Includes paralysis present at any time during illness even though it has disappeared at the time of your visit.

CD 316 (8/53) Rev.

Information on household members

Person number	Current case of polio	Name	Relation to index case	Age	Sex	History of previous paralytic polio		Occurrence in month preceding onset of index case of						If female, date onset of last menstrual period before onset of index case			If pregnant which trimester	Gamma globulin		
								Throat, mouth and other operations			All injections							Date injected		
						Date		Type	Date		Type and site	Date		Date				1953		Number of cubic centimeters if known and site if known
						Mo.	Yr.		Mo.	Da.		Mo.	Da.	Mo.	Da.	Yr.		Mo.	Da.	
1		Index case																		
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Name of investigator ---------- Date ---------- Name of informant ----------

39087—53—Pt. 3——6

[Form CD 144A]

INFECTIOUS HEPATITIS SUPPLEMENTARY REPORT

Instruction sheet

The supplementary report should be completed 6 weeks after onset of index case.

Item 1: This is the index case.

Item 4: If the patient is a schoolchild, enter the name of the school, the grade, and, if there are 2 or more classes per grade, identify the classroom.

Item 6: Infectious hepatitis usually has prodromal symptoms of fever, anorexia, nausea with or without vomiting, fatigue, lassitude, headache, and abdominal discomfort, especially in the right upper quadrant and epigastrium. The discomfort may range from pain to a heavy or dragging sensation. After a few days fever subsides, the urine may be dark due to bile, and jaundice appears. The illness may last 1 or 2 weeks or months. Rarely it is chronic. Fatalities are rare.

The onset must be determined accurately in order to evaluate the prophylactic value of GG (gamma globulin). GG is ineffective if given at too late a date after exposure.

Items 7 and 8: The dates of recovery and of return to usual activity obviously may differ. These items are intended to indicate the severity of the disease and the adequacy of medical care.

Item 21: This refers to earlier illnesses, and not to illnesses within 6 weeks of the onset of the index case.

Jaundice and hepatitis are not synonymous. Jaundice is a symptom which may be due to gall-bladder disease and gallstones, and to other conditions, as well as hepatitis.

If there is a past history of hepatitis, enter the date, and the diagnosis as the person knows it, such as "infectious hepatitis, United States Army, 1943."

If there is a past history of jaundice, enter the date, and the cause as the person knows it, for example, gall bladder, blood transfusion. If he doesn't know the cause, merely note it as, for example, jaundice, 1920 or jaundice, United States Army, 1943.

Item 22: EDC, expected date of confinement.

Item 23: This concerns the protection of the household members against infectious hepatitis.

In the rare event that the index case and/or members of the household had GG for other purposes, (poliomyelitis, measles, rubella) within 2 months preceding the onset of the index case, please enter it under item 23, together with any GG given in connection with infectious hepatitis in the index case. Check the forms CD 318 on file to see if GG had been given earlier.

Item 29: If jaundiced enter the date jaundice was first noted.

NOTE.—If serum hepatitis, complete form CD 144, homologous serum jaundice, supplementary report.

[Form CD 144A]

NEW YORK STATE DEPARTMENT OF HEALTH

BUREAU OF EPIDEMIOLOGY AND COMMUNICABLE DISEASE CONTROL

INFECTIOUS HEPATITIS

Supplementary Form

1. Patient's name _____ 2. Age _____ 3. Sex _____
4. Occupation or school (name, grade, classroom) _____
5. Address _____ City / Town / Village _____ County _____
6. Date onset:
   First symptoms _____
   Jaundice _____
7. Date of recovery _____
8. Date return:
   To work _____
   Or school _____
9. Physician's name _____
10. Hospital: Name _____ Date admission _____ Date discharge _____
11. Was the patient directly exposed to someone with hepatitis within 2–5 weeks of onset? Yes ☐ No ☐ Unknown ☐
    If yes, to whom exposed? Name _____ Address _____
    How exposed? (such as schoolroom, same office, home visit, same school bus) _____
12. Did the patient have whole blood or blood products within 6 months of onset? Yes ☐ No ☐
    (If yes, please complete CD 144 for this case.)
13. Number of rooms in the household (do not count bathrooms, closets, pantries, halls, screened porches and unfinished rooms in the attic or basement) ____
14. Water supply: Municipal ☐ Drilled well ☐ Dug well ☐ Spring ☐ other _____
15. Sewage disposal: Municipal ☐ Cesspool ☐ Septic tank ☐ Privy ☐
    Usual milk supply: Raw ☐ Pasteurized ☐ Name of dealer _____

Household roster

16	17	18	19	20		21	22		23			
				Veteran			Pregnant (EDC)		Gamma globulin			
Number	Name	Age	Sex	Yes	No	History of hepatitis of jaundice [1] date and diagnosis	Yes	No	Yes (date)	No	Dose	Weight in pounds
1	Index case	x	x									
2												
3												
4												
5												
6												
7												

[1] This refers to earlier illnesses and *not* to illnesses within 6 weeks of the onset of the index case (instruction sheet).

24. Did any of the household members have hepatitis or an illness suggestive of it (see reverse) within the period 6 weeks before to 6 weeks after the onset of the index case? Yes ☐ No ☐
    If yes, please enter the information in the correct roster number on the reverse.

Hepatitis or suspicious illness [1] within period 6 weeks before to 6 weeks after onset of index case

25	26	27		28	29										30	31	32	
Number	Occupation or school (name, grade, classroom)	Blood or blood product 6 months onset		Date onset first symptoms	Symptoms										Date recovery	Date returned to work or school	Physician	
					Jaundice		Anorexia		Nausea		Fatigue		Abdominal pain					
		Yes	No		Yes [2]	No	Yes	No	Yes	No	Yes	No	Yes	No			Name	Diagnosis
2																		
3																		
4																		
4																		
6																		
7																		
8																		

[1] Illnesses to be described here include:
(*a*) Illness diagnosed as acute hepatitis by a physician.
(*b*) Illnesses either not seen by a physician, or seen by a physician and not attributed to another clear-cut cause, such as gallstones, influenza, pneumonia.
The illness should be marked by:
(1) Jaundice of any duration; or
(2) By prominent anorexia, nausea, fatigue, abdominal pain, or combination thereof, of at least 1 week's duration.

[2] Date first noted.

33. Comments _____

34. Source of information _____ Investigator _____ Title _____

35. Date investigated _____

NEW YORK STATE DEPARTMENT OF HEALTH,
BUREAU OF EPIDEMIOLOGY AND COMMUNICABLE DISEASE CONTROL,
August 27, 1953.

Supplement to supplement MP CD 53: 701.
To: Regional health officers, district State health officers, city and county health commissioners.
From: Dr. Korns.
Subject: Additional question on residence in camps to be included in a revised CD 316 (poliomyelitis supplemental report).

The attached CD 316 (8/53) second revision (poliomyelitis supplemental report) is to be used in place of the form issued August 7, 1953.

The recent pressure and desire of many groups to include camp associates of a poliomyelitis case in the allocation of gamma globulin has highlighted the need to know more precisely the hazard to camp associates after a case of poliomyelitis has occurred.

Published knowledge on this subject is limited. Ingalls and Rubenstein's analysis of a 14-year experience in camps in New England showed no poliomyelitis cases in 79 percent of the camps, single case outbreaks in 14 percent and multiple-case outbreaks in 7 percent (Rubenstein and Ingalls; Expectancy for Outbreaks of Poliomyelitis in Camps and Schools, American Journal of Public Health, 40: 555, 1950). Secondary cases, they found, can be expected to develop in about 20 percent of camps after a single case has occurred. Approximately one half of the secondary cases occurred during the first 5 days following onset of a case in a pattern similar to the occurrence of multiple household cases.

The experience in upstate New York for a recent year, namely, 1949 showed that of 69 camps where poliomyelitis occurred, 47 had single cases. The remaining 22 camps accounted for cases as follows: In 9 camps there were 2 cases, in 12 camps there were variations from 3 to 7 cases, and in 1 camp 10 cases. No information is available, however, on the attack rate of secondary cases among camp associates exposed to a case of poliomyelitis.

In adding this question to the poliomyelitis supplemental report it is hoped that the camps where poliomyelitis cases have occurred will be pinpointed. In addition, camps will be identified for those cases where onset of symptoms developed soon after leaving the area. The camp directors will then be questioned by a letter from this bureau as to the population present in the camp at the time of onset of the case. We understand, after inquiry on this point, that camp directors can be expected to supply a fairly accurate estimate of the number of persons by rough age groups. Occurrence of any secondary cases in this exposed population will then supply attack rates. These attack rates will, in turn, be weighed against the attack rates in family associates of a case. It is hoped that some measure of the efficiency of gamma globulin in the two situations can thus be arrived at.

In regard to those cases that have already been followed up prior to the present revision of CD 316, the question as to camp residence may remain unanswered. In some cases, however, where the point may be recalled by the interviewer or settled by a phone call, the additional information might be entered under remarks.

R. F. K.

Endorsed: V. A. VAN VOLKENBURGH, M. D.

NEW YORK STATE DEPARTMENT OF HEALTH

POLIOMYELITIS SUPPLEMENTAL REPORT

Name of patient _____ Age ____ Color ____ Occupation _____

Home address _____ (Street and number) City Village _____ Town County _____

Was patient at camp at any time during 4 weeks prior to onset? Yes ☐ No ☐

Dates _____ Name of camp _____ Address _____

Date of onset _____ Hospitalized Yes ☐ No ☐

Attending physician _____ (Name) Address _____

Hospital name and address: 1 _____ Date admitted _____ Date discharged _____

2 _____ Date admitted _____ Date discharged _____

Was spinal tap performed? Yes ☐ No ☐ Unknown ☐

Diagnosis: Nonparalytic ☐ Paralytic ☐ Diagnosis questionable ☐

Extent of paralysis:[1]

Bulbar ☐ Trunk ☐ Other (specify) ☐

Arm, right ☐ Leg, right ☐

Arm, left ☐ Leg, left ☐

Died: Yes ☐ No ☐ Date _____

Source of information on diagnosis and paralysis:

Attending physician ☐ Hospital record ☐

Mother or patient ☐ Physical therapist grading ☐

Other ☐

Are the parents of patient related by blood in any manner? Yes ☐ No ☐

If yes, state relationship _____

If any of household members are twins identify by "person number" as listed on reverse: _____ and _____ (if one twin not present in household, give name and address below).

Are they Identical twins ☐ Fraternal twins ☐ Not specified ☐

Remarks _____

[1] Include paralysis present at any time during illness even though it has disappeared at the time of your visit.

CD 316 second revision, August 27, 1953.

Information on household members

Person number	Current case of polio	Name	Relation to index case	Age	Sex	History of previous paralytic polio		Occurrence in month preceding onset of index case of						If female, date onset of last menstrual period before onset of index case			If pregnant which trimester	Gamma globulin		
								Throat, mouth and other operations			All injections							Date injected		Number of cuble centimeters if known and site if known
						Date		Type	Date		Type and site	Date		Date				1953		
						Mo.	Yr.		Mo.	Da.		Mo.	Da.	Mo.	Da.	Yr.		Mo.	Da.	
1		Index case																		
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Name of investigator---------- Date---------- Name of informant----------

Memorandum MAY 18, 1953.

To: Regional health directors, county health commissioners, district health officers, city health officers, and other concerned.

From: Dr. Van Volkenburgh.

Subject: Office manual—communicable disease.

Please insert in the office manual the attached pages pertaining to the distribution of gamma globulin phrophylaxis for poliomyelitis, infectionus hepatitis, measles, and rubella (German measles). It is suggested that all office personnel who may be concerned with this distribution review this material very carefully.

For your convenience conversion tables are enclosed.

Please add the following to the index pages of the communicable disease section of the office manual:

17. Gamma Globulin Prophylaxis for Poliomyelitis, Infectious Hepatitis, Measles and Rubella (German measles).

Please add the following to the list of forms in paragraph 1:

CD 318 Physicians Request for Gamma Globulin.

CD 319 Gamma Globulin Inventory.

An initial supply of the above forms is attached. This supply could be replenished by ordering them on your regular supply order.

W ——— ———.

17. *Gamma globulin prophylaxis for poliomyelitis, infectious hepatitis, measles, and rubella (German measles)*

(*a*) *Requests for gamma globulin.*—Upon request from physician for gamma globulin prophylaxis for poliomyelitis, complete front of form CD 318, physicians request for gamma globulin. Upon request from physician for gamma globulin prophylaxis for infectious hepatitis, measles, or rubella (German measles) complete reverse of form CD 318. Check appropriate square for disease. Use additional form CD 318 if necessary to list additional contacts. Fill in patient's name at top of second sheet as it appears on first sheet for identification purposes and staple to first sheet. In all instances use name of index case in space provided for patient's name.

Any given individual is permitted to receive one immunizing dose per calendar year.

Gamma globulin will be distributed according to the following:

Disease	Dose per pound	Size of vials	Special instructions
	Cubic centimeters		
Poliomyelitis prophylaxis.	0.14	10 cubic centimeters.	For household contacts under 30 years of age and pregnant women and nurses of all ages. For example if the total weight of all contacts equal 300 pounds authorize distribution of 42 cubic centimeters or 5 vials.
Infectious hepatitis	.01	1 and 2 cubic centimeters.	For example if total weight of all contacts equals 300 pounds authorize distribution of 3 cubic centimeters.
Measles	.02	do	For modification.
	.1	do	For prevention.
			Use is restricted to children under 4 years of age or debilitated children. Modification is preferred since this allows for permanent immunity. For example if total weight of all contacts equals 150 pounds authorize distribution of 3 cubic centimeters if for modification, or 15 cubic centimeters if for prevention.
Rubella (German measles)	.1	do	For exposed pregnant women in 1st trimester only. Maximum allowance is 12 cubic centimeters. For example if body weight equals 125 pounds authorize distribution of 12 cubic centimeters.

(*b*) *Authorization for issuance.*—Issue physician an authorization number which must be given by him to the laboratory supply station before gamma globulin is issued. Supply station will record this number on form 97, distribution of prophylactic and therapeutic preparations. Supply station will maintain one form 97 for gamma globulin prophlaxis for poliomyelitis, infectious hepatitis, measles, and rubella (German measles).

Authorization number is to consist of two parts. First part is to be the control number, and the second part is the code number to the supply station as to the number of vials to be distributed. For example if the first issuance for gamma globulin for poliomyelitis prophylaxis is to be for 5 vials the authorization number will be P 1–5, if the second authorization is for 4 vials the authorization number will be P 2–4, etc. If the first issuance for gamma globulin for infectious hepatitis, measles, or rubella (German measles) is to be for 3 vials the authorization number will be X 1–3; if the second authorization is for 2 vials the authorization number will be X 2–2, etc.

On weekends and holidays DSHO or commissioner will complete form CD 318 and issue authorization to private physician as described above with the exception that the control number would be eliminated. For example, if 3 vials of gamma globulin for poliomyelitis prophylaxis is to be issued, the authorization number will be P–3.

(c) *Records and reports.*—(i) Enter amount of gamma globulin authorized on form CD 319, gamma globulin inventory. A separate form CD 319 should be maintained for gamma globulin prophylaxis for poliomyelitis and a separate form CD 319 should be maintained for infectious hepatitis, measles, and rubella (German measles), and a separate set should be maintained for each designated laboratory supply station. Start with No. 1 for each CD 319. This form will be used as a perpetual inventory and will also be used to check form 97, distribution of prophylactic and therapeutic preparations, which should be received from the supply stations each week.

(ii) If on a weekend or holiday laboratory supply station issues any gamma globulin which was authorized by DSHO or commissioner completed form CD 318 should be brought into the office by the DSHO or commissioner. Upon receipt note distribution on appropriate form CD 319. In the authorization number column write "H. O." to indicate that the laboratory supply station distributed the gamma globulin through the DSHO or commissioner's authorization.

(iii) Upon receipt of form 97, distribution of prophylactic and therapeutic preparations, each week from the supply station check each form CD 319 to see that the supply station has distributed gamma globulin for which distribution has been authorized. If no gamma globulin was issued during the week by the supply station, the supply station should forward this form with the notation "None" to your office. Forward form 97 each week to the division of laboratories and research in Albany. If gamma globulin has been distributed for which no prior authorization has been granted by the office refer immediately to the DSHO or commissioner.

(iv) When the division of laboratories and research forwards to the laboratory supply station a supply of gamma globulin for poliomyelitis prophylaxis, infectious hepatitis, measles, or rubella (German measles) a copy of the shipping memorandum (yellow) will be received in the office. Enter date and amount of gamma globulin sent to the supply station on appropriate form CD 319.

(v) Each week check forms CD 318 for which gamma globulin has been issued to see if case report has been received. If not, follow up for case report.

(vi) Form CD 318 for which gamma globulin for poliomyelitis prophylaxis has been issued is to be retained until form CD 316 (revised), poliomyelitis supplementary report, for case has been obtained (see par. 5). When form CD 316 is to be retained until form CD 144 (ervised) for case has been obtained. When and communicable disease control.

Form CD 318 for which gamma globulin for infectious hepatitis was distributed is to be retained until form CD 144 (revised) for cases has been obtained. When form CD 144 (revised) is complete staple to form CD 318 for which gamma globulin for infectious hepatitis has been distributed and forward both to the bureau of epidemiology and communicable disease control.

Form CD 318 for which gamma globulin for measles has been issued is not needed in the central office. Only reason for maintaining is to check distribution of gamma globulin. After inventory check, discard this form unless DSHO or commissioner desires to retain.

Form CD 318 for which gamma globulin for rubella (German measles) has been issued is to be forwarded to the bureau of epidemiology and communicable disease control after inventory check.

Conversion table—Gamma globulin

[Poliomyelitis prophylaxis—0.14 cubic centimeter per pound]

[Infectious hepatitis—0.01 cubic centimeter per pound]

[Measles—0.02 cubic centimeter per pound for modification; 0.01 cubic centimeter per pound for prevention]

Pounds	Polio (cubic centimeters)	Infectious hepatitis (cubic centimeters)	Measles[1] modification (cubic centimeters)	Pounds	Polio (cubic centimeters)	Infectious hepatitis (cubic centimeters)	Pounds	Polio (cubic centimeters)	Infectious hepatitis (cubic centimeters)
8–10	1.5	0.5	0.5	72–75	10.5	1.0	136–139	19.5	1.5
11–14	2.0	.5	.5	76–78	11.0	1.0	140–142	20.0	1.5
15–17	2.5	.5	.5	79–82	11.5	1.0	143–146	20.5	1.5
18–21	3.0	.5	.5	83–85	12.0	1.0	147–150	21.0	1.5
22–25	3.5	.5	.5	86–89	12.5	1.0	151–153	21.5	2.0
26–28	4.0	.5	1.0	90–92	13.0	1.0	154–157	22.0	2.0
29–32	4.5	.5	1.0	93–96	13.5	1.0	158–160	22.5	2.0
33–35	5.0	.5	1.0	97–100	14.0	1.0	161–164	23.0	2.0
36–39	5.5	.5	1.0	101–103	14.5	1.5	165–167	23.5	2.0
40–42	6.0	.5	1.0	104–107	15.0	1.5	168–171	24.0	2.0
43–46	6.5	.5	1.0	108–110	15.5	1.5	172–175	24.5	2.0
47–50	7.0	.5	1.0	111–114	16.0	1.5	176–178	25.0	2.0
51–53	7.5	1.0		115–117	16.5	1.5	179–182	25.5	2.0
54–57	8.0	1.0		118–121	17.0	1.5	183–185	26.0	2.0
58–60	8.5	1.0		122–125	17.5	1.5	186–189	26.5	2.0
61–64	9.0	1.0		126–128	18.0	1.5	190–192	27.0	2.0
65–67	9.5	1.0		129–132	18.5	1.5	193–196	27.5	2.0
68–71	10.0	1.0		133–135	19.0	1.5	197–200	28.0	2.0

[1] For prevention multiply weight by 0.1 to obtain number of cubic centimeters.

For rubella (German measles) multiply weight of pregnant woman by 0.1 cubic centimeter. Maximum dose per individual is 12 cubic centimeters.

PHYSICIAN'S REQUEST FOR GAMMA GLOBULIN—POLIOMYELITIS PROPHYLAXIS

Gamma globulin is issued for contacts of reported cases only, not for treatment. Issued for persons who have been in direct physical contact at some time during the previous 12 days with a reported case of poliomyelitis in the communicable stage (3 days before to 7 days after onset of illness).

Dosage: Poliomyelitis, 0.14 cubic centimeters per pound of body weight.

District, city, or county health office _____ Authorization No. _____
Patient _____ Present address _____
Date onset _____ Age ____ Usual residence (if different) _____
Paralytic: Yes ☐ No ☐
If not paralytic: Stiff neck ☐ Stiff back ☐ Spinal fluid examined ☐ Results _____

HOUSEHOLD CONTACTS

Administration of gamma globulin will be limited to household contacts under 30 years, pregnant women, and nurses of all ages.

Name	*Age*	*Wgt.*	*Cc.'s*[1]
_____	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____ Total cc.'s ____

Date to be administered _____

NONHOUSEHOLD CONTACTS [2]

Administration of gamma globulin will be limited to nonhousehold contacts under 21 years of age, all pregnant women, and all nurses caring for poliomyelitis patients in the communicable stage.

	Describe type of contact	*Age*	*Wgt.*	*Cc.'s*
Name				
Address				
Name				
Address				
Name				
Address				Total cc.'s

Total approved

Describe circumstances of contact and justification for request

[1] See conversion table for number of cubic centimeters.
[2] Nonhousehold contacts: This form not to be used routinely for mass prophylaxis.

Physician Authorized by (Health officer) Date

Address Name of laboratory supply station

Notify physician case report must be prepared for the index case

PHYSICIAN'S REQUEST FOR GAMMA GLOBULIN PROPHYLAXIS

Gamma gobulin is issued for contacts of reported cases only, not for treatment. Issued to persons who have been in direct physical contact with a reported case in the communicable stage of:

Disease	Exposure within	Dosage per pound body weight	Limitations
		Cc.[1]	
☐ Infectious hepatitis	Previous 20 days	0.01	All ages.
☐ Measles (modification)	Previous 9 days	0.02	Under 4 years.
☐ Measles (prevention)	do	0.1	Debilitated children.
☐ Rubella (German measles)	Previous 12 days	0.1	Women in first trimester of pregnancy.

[1] Maximum 12 cubic centimeters.

District, city, or county health office Authorization No.
Patient Present address
Date onset Age Usual residence (if different)

HOUSEHOLD CONTACTS

Name	*Age*	*Wgt.*	*Cc.'s* [1]	*Rubella*	
				Date contact	*Expected date confinement*
			Total cc.'s		

NONHOUSEHOLD CONTACTS [2]

	Describe type of contact	Age	Wgt.	Cc.'s [1]	Rubella: Date contact	Rubella: Expected date confinement
Name						
Address						
Name						
Address						
Name						
Address						

Total cc.'s ____ Total approved ____

Describe circumstances of contact and justification for request _____

[1] See conversion table for number of cubic centimeters.
[2] Nonhousehold contacts: This form not to be used routinely for mass prophylaxis, e. g., camps, institutions, schools, etc.

Physician _____ Authorized by _____ (Health officer) Date _____

Address _____ Name of laboratory supply station _____

Notify physician case report must be prepared for the index case

GAMMA GLOBULIN INVENTORY

Laboratory Supply Station _____ Disease

Date	Amount on hand	Amount received	Name of case	Authorization No.	Amount authorized	Balance

Memorandum.

MAY 27, 1953.

To: Regional health directors, county health commissioners, district health officers, city health officers, and others concerned.

From: Dr. Van Volkenburgh.

Subject: Office Manual—Communicable Disease Section.

We have received word that part of the supply of gamma globulin prophylaxis for poliomyelitis received from Washington was packed in 2 cubic centimeter vials. Originally it was anticipated that all of the gamma globulin prophylaxis for poliomyelitis was to be packaged in 10 cubic centimeter vials only. However, it is expected that when the supply of 2 cubic centimeter vials is exhausted all of the vials would contain 10 cubic centimeters.

As long as the supply of 2 cubic centimeter vials is available the laboratory supply stations should distribute the exact amount of gamma globulin prophylaxis for poliomyelitis or to the next multiple of 2. For example if 32 cubic centimeters are authorized for distribution the exact amount should be distributed. If 33 cubic centimeters are authorized for distribution 34 cubic centimeters should be distributed by the supply station. When there is no longer a supply of 2 cubic centimeter vials the laboratory supply stations should distribute the gamma globulin prophylaxis for poliomyelitis to the next multiple of 10. For example if the authorization number reads P 1–32, the supply stations should distribute four 10 cubic centimeter vials.

It has also been determined that gamma globulin prophylaxis for infectious hepatitis measles, and rubella (German measles) will be available in 2 cubic centimeter vials only. Therefore the amount authorized should be to the next multiple of 2 if the total amount of cubic centimeters is an odd number.

In view of the above it is necessary to change certain items in the communicable disease section of the Office Manual.

In paragraph 17a under special instructions for poliomyelitis prophylaxis delete the last 3 words "or 5 vials".

For infectious hepatitis under the size of vials column delete "1 and" and under special instructions change "3 cubic centimeters" to "4 cubic centimeters."

For measles under the size of vials column delete "1 and" for both modification and prevention. Under special instructions change "3 cubic centimeters" to "4 cubic centimeters" and "15 cubic centimeters" to "16 cubic centimeters."

For rubella (German measles) under the size of vials column delete "1 and".

In paragraph 17b delete the last 2 subparagraphs and replace them with the following 2 paragraphs.

"Authorization number is to consist of two parts. First part is to be the control number and the second part is the code number to the supply station as to the number of cubic centimeters to be distributed. For example if the first issuance for gamma globulin for poliomyelitis prophylaxis is to be for 42 cubic centimeters the authorization number will be P 1–42, if the second authorization is for 38 cubic centimeters the authorization number will be P 2–38, etc. If the first issuance for gamma globulin for infectious hepatitis, measles, or rubella (German measles) is to be for 3 cubic centimeters the authorization number will be X 1–4, if the second authorization is for 2 cubic centimeters the authorization number will be X 2–2, etc.

"On weekends and holidays DSHO or commissioner will complete from CD 318 and issue authorization to private physician as described above with the exception that the control number would be eliminated. For example, if 38 cubic centimeters of gamma globulin for poliomyelitis prophylaxis is to be issued the authorization number will be P–38."

W ——— ———.

Dr. ANDREWS. We have a group of people who represent clinical interest, public-health interest, and epidemiology interest this afternoon.

The first area of discussion which I should like to introduce is the scientific background of gamma globulin, its use, in what diseases it has proved to be useful, and the basis for its utilization so far as poliomyelitis is concerned, how gamma globulin differs from what doctors call vaccines and whether or not those substances have any effect upon natural immunizing processes which otherwise might occur.

I should like to present Dr. Stokes to lead the discussion in this phase.

STATEMENT OF DR. JOSEPH STOKES, PHYSICIAN IN CHIEF, CHILDREN'S HOSPITAL, PHILADELPHIA, PA.

Dr. STOKES. Dr. Andrews and Mr. Chairman, I shall try to speak quite informally on the background of gamma globulin. It is a portion of the blood plasma. The blood is made up of two elements—the cells and the liquid or the plasma. The gamma globulin represents a portion of the liquid part of the blood which contains the antibodies or substances which protect against various disease organisms including viruses.

There is another portion of the blood—the fatty material—which has a small amount of antibody, but almost all the antibody in the blood is in the gamma globulin.

When it was found that most of the antibodies were in the gamma globulin, it was obviously worthwhile to concentrate the antibodies from the plasma itself. This was carried out originally by such methods as ammonium sulfate precipitation. That was before the 1920's and in the 1920's. Finally the gamma globulin was precipitated out by the alcoholic precipitation method, developed chiefly by Dr. E. J. Cohn and others at the Harvard Medical School.

The CHAIRMAN. I might say that during the hearing this morning we did insert in our record a small tribute—small in view of the great importance of the man—to Dr. Cohn.

Dr. STOKES. Before 1942 when this method was fully developed, gamma globulin had been used quite successfully against measles, both for prevention and in modifying the severity of the disease, according to the amount given. It was tested and after 1942 when the method of alcoholic fractionation was used also in measles quite successfully and a little later in 1944 it was determined that it was successful also in certain forms of jaundice. It was used in the Mediterranean theater and elsewhere during World War II and was quite effective in protecting against and also in modifying the disease. About that time it was also used in studies concerning poliomyelitis, but they were quite inconclusive in the early days.

Later on, it seemed worthwhile to determine its effect in large outbreaks of the disease. This was done with the help of funds from the National Foundation for Infantile Paralysis and, of course, with the Red Cross collecting the blood and having it fractionated in the manner which I have mentioned. In 1951 and 1952 in Utah, then in Houston, Tex., and in Iowa and later Nebraska, extensive experiments were carried out to determine its effects in preventing poliomyelitis. These appeared to be successful.

The cases in any one epidemic of polio are not sufficient in number to furnish large figures which are highly significant statistically, but there were a sufficient number of cases in the combined outbreaks in which it was used to indicate that gamma globulin was effective on a statistically significant basis.

The great question which arises with the use of gamma globulin in all virus infections is whether when one uses gamma globulin to protect individuals against the disease and those individuals do not develop infection do they become completely susceptible again in 5 or 6 or 7 weeks when the gamma globulin disappears from the blood. That is one of the questions we are particularly interested in in the field of poliomyelitis in the studies which I have just mentioned.

One of the interesting points that has been recently determined by Dr. Hammond, and Dr. Coriell of Philadelphia, is the fact that in these studies, particularly in Sioux City, it was found that those children injected with gamma globulin or with gelatin, these latter were the controls, and the uninjected group, all had the virus of poliomyelitis present in their stools. This indicated that apparently there was not complete protection. The only thing the gamma globulin did was to prevent paralysis, but infection actually occurred in those injected with gamma globulin, those injected with gelatin, and those that had no injection. The same percentage of cases that had the gamma globulin had virus in their stools, as in the other two groups.

This strongly suggests infection, which is desirable, because it was hoped that the protection would not be temporary, and that those individuals injected with gamma globulin would become permanently immune. Thus, if the virus attacked them, they would develop their own antibodies as any other child would that was attacked.

Another point that seems important to mention is the fact that in the rare instances where children injected with gamma globulin were exposed in the same household to a child with paralytic poliomyelitis, it was shown by Dr. Coriell on five occasions by means of blood tests made when the gamma globulin was administered and again after the paralysis had developed in a brother or sister, that the level of antibodies against poliomyelitis had increased. This also indicates

that infection had occurred, that paralysis had been prevented, and that the gamma globulin protected children had probably become immune to the type of poliomyelitis which caused the paralysis in the household.

These two points are particularly important because the question has been raised: Does gamma globulin produce a temporary immunity and then leave the child or individual more susceptible to paralysis at a later age? Paralysis is more apt to occur when individuals are infected in later life. Apparently from the data we can conclude that gamma globulin has protected against paralysis only and not against immunizing infection, and that, it seems to me, is very important.

I think that covers the points I wanted to mention now.

The CHAIRMAN. You made mention of Dr. Coriell, of Philadelphia. Is he the doctor who is the superintendent at the Camden Institution?

Dr. STOKES. Yes, sir, he is; he is attached to the University of Pennsylvania in the department of pediatrics and is medical director of the Camden Municipal Hospital.

The CHAIRMAN. I might say that we are very well pleased with the work he is doing there.

I believe Mr. Doliver has some questions at this point.

Mr. DOLLIVER. Did I understand you to say that gamma globulin is a derivative of human blood and that it is one of the elements that is found in the bloodstream?

Dr. STOKES. That is right. The gamma globulin is taken from blood and has antibodies in it against these various diseases. Because of the pooling of adult blood there are antibodies present against many diseases and generally at a high level. As gamma globulin represents a twenty- to twenty-five-fold concentration of blood plasma, the antibodies are more abundant in gamma globulin than in an ordinary pool of plasma.

The CHAIRMAN. Now, this gamma globulin was not originally developed for the purpose of combating poliomyelitis, was it?

Dr. STOKES. No, sir; it was developed originally for other purposes, but gamma globulin is present in every normal human being.

The CHAIRMAN. It was not taken as a separate element of the blood specifically for the purpose of giving in cases of polio? As an original matter it was used previously for the treatment of or resistance to other diseases than polio; is that not correct?

Dr. STOKES. It was used originally to protect children against measles or to modify the disease.

The CHAIRMAN. And this application to the prevention of the incidence and the severity of polio was a new application of the same material?

Dr. STOKES. That is correct.

The CHAIRMAN. I realize that there are some experiments going on now to artificially create or synthetize this material from other elements than the blood?

Dr. STOKES. Those experiments to my knowledge have not been very successful as yet in synthetizing such material in order to produce additional amounts, the way we produce antitoxins in a horse. There are some studies which have been carried out along that line; this is called hyperimmunization.

Mr. DOLLIVER. That is not precisely what I mean. I find myself rather at a loss to find the proper words to express what I have in mind, but there are some elements of the blood which can be made in the laboratory, are there not? It seems to me that there are some one or the other of the many laboratories of the country making certain elements of the blood, which they use instead of natural blood?

Dr. STOKES. I think probably you are referring to blood extenders or expanders, such as dextran.

Mr. DOLLIVER. That is right. It is dextran.

Dr. STOKES. They are not blood elements. There has been to my knowledge no one who has actually synthetized the proteins of the blood.

Dr. DOLLIVER. Well, that brings me to the point then, if this gamma globulin cannot be produced in the laboratory, it must come from the human blood?

Dr. STOKES. That is correct.

Mr. DOLLIVER. You mentioned a moment ago that some form of antitoxins are developed in the bodies of lower animals, and are used by human beings. Is there any possibility in that field for gamma globulin there which has not been explored?

Dr. STOKES. It may be possible to develop antibodies in animals against the various viruses, particularly by hyperimmunizing animals, but there is no work as yet which indicates that that would be feasible, to my knowledge. But, I think, in the future certain studies of that sort will be carried out. If human antibodies are available, they are somewhat more effective in smaller amounts than animal antibodies.

Mr. DOLLIVER. But the supply is not so plentiful.

Dr. STOKES. That is right.

Mr. DOLLIVER. Now, in these experiments which you referred to—some of which were held in my home State of Iowa, in Sioux City—what was the procedure?

Dr. STOKES. There was a poliomyelitis epidemic in Sioux City. When the epidemic reached the proportion of the rate of 20 cases per 100,000 population a scout was sent in to determine the situation. The public health officer of the State, the president of the county medical society and president of the State medical society, the mayor of the town, and other officials were contacted, and it was determined whether they were interested—particularly the county medical society—in having work carried out in that city. Then a team came in which had already been set up and had worked at Houston and in Utah. It was headed by Dr. Coriell and Dr. Hammond. Dr. Hammond was the general director and Dr. Coriell was the man who did the actual work. In addition, a large group of doctors came into the town at the request of the county medical society, and there was a large corps of physiotherapists for judging muscular changes, and many other voluntary workers. In other words, a large group was set up with the full approval of everyone concerned.

Mr. DOLLIVER. Did they undertake to inject every child in the community?

Dr. STOKES. No, sir; there was not an effort to inject every child with gamma globulin. The syringes were prepared and set up in boxes in such a way that in every box 50 syringes were filled with gamma globulin or gelatin and each of them was simply marked with a number. The number was put on the child's chart and there were

only 2 individuals that knew the key to those numbers, 1 in New York City and 1 in the Squibb Co., and that was all. When a line of 50 children had gone by 25 had been injected with gelatin and 25 with gamma globulin, and it was not known by the individuals making the injections, or anyone else, except the 2 who had the key to the numbers, which child had received which material, because the gelatin and gamma globulin looked precisely alike. Even when you shook them you could not tell the difference between them.

Mr. DOLLIVER. The gelatin was supposed to be neutral without any effect whatever?

Dr. STOKES. That is correct. It has been used as one of the plasma expanders.

Mr. DOLLIVER. Then the evaluations were made from the charts of these various children after the injections had been completed and after the study was made?

Dr. STOKES. That is right. No one knew until the end of the studies when the key was opened and it was then determined which child had had gelatin and which gamma globulin.

Mr. DOLLIVER. I take it from what you said previously that there is no other source of gamma globulin than human blood?

Dr. STOKES. Not at the moment.

Mr. DOLLIVER. Does the medical profession anticipate that there will be other sources?

Dr. STOKES. It may be possible in animals, but it has not been developed as yet.

Mr. DOLLIVER. How much blood does it take for one dose of this substance?

Dr. STOKES. One dose requires the amount of about a single donation.

Mr. DOLLIVER. So for every child that is injected some individual must supply the blood?

Dr. STOKES. Yes, sir.

Mr. DOLLIVER. From what I have observed in the newspapers there is not a sufficient amount of this gamma globulin to supply the demand, at least, or perhaps even the need?

Dr. STOKES. I think others might answer that better than I could.

Mr. DOLLIVER. All right, I will defer that question. I think that is all.

Mr. PRIEST. Mr. Chairman, I have one question which I would like to ask at this time.

Doctor, could you give us approximately the percentage of efficiency of gamma globulin in preventing the paralysis effect of polio? Is it quite effective in that respect?

Dr. STOKES. In the studies that were carried out during the first week, there appeared to be very slight, if any, effect; there may have been some reduction in the extent of paralysis during the first week. During the second week the results seemed to indicate protection, as judged by the smaller number of cases in the gamma globulin group, as compared to the gelatin-control group, and as compared to those that had not received any injection. During the third and fourth weeks, the numbers of cases were not large enough to be highly significant but there again the results appeared to be favorable. They were significant statistically when added together with the results

of the first and second weeks. It is not known after the fourth week whether there was any effect from the injection of gamma globulin. That, I think, is as far as we can go at the present time.

Mr. PRIEST. Thank you, sir. That is all.

The CHAIRMAN. Are there any further questions, gentlemen?

Mr. HESELTON. I was not able to hear all of your statement and perhaps this is repetitious. If so, tell me and we will not pursue it.

I read this morning of some discussion here in the District of a meeting at which they had discussed the effects of this kind of injection. Did you happen to see the report?

Dr. STOKES. Was that the report by Dr. Ward?

Mr. HESELTON. I think so.

Dr. STOKES. I saw a note in the paper.

Mr. HESELTON. He raised some very important questions, it seems to me, as to the result or the possible results of this treatment.

Dr. STOKES. I believe if the newspaper had outlined carefully the data that Dr. Coriell gave at the same meeting, and which I presented here a few moments ago, concerning the virus in the stools and the rise of antibodies in those children who had gamma globulin and were exposed to paralytic cases, that the account would have been based upon accurate data and actual facts, rather than the hypothesis that Dr. Ward gave. Dr. Ward advanced the hypothesis that perhaps the gamma-globulin-injected children were completely protected and would be later susceptible. That was the note of the headlines in the paper. Actually, Dr. Ward had no data on which to base those statements. They may still be true, but all of the data in animals—in chimpanzees—as a result of the work conducted by Dr. Bodian and others, and all the data we now have in human beings, strongly suggests that the opposite is true. My feeling is that up to the present time we should go on actual scientific data, and not on hypotheses. Dr. Ward's statement was based purely on hypothesis.

Mr. HESELTON. Was there not some objection raised at a meeting recently held in Rome in regard to this matter?

Dr. STOKES. I believe that was at a committee meeting of the World Health Organization. There, again, I think the reporting was unfortunate. When one reads the statement carefully, it did not contain all the statements that the headlines in the paper implied.

Mr. HESELTON. Do you know of the statement or the expression of opinion by Dr. Paul of Yale?

Dr. STOKES. I do not know exactly what Dr. Paul's opinion is, but I think I know it fairly well. I believe he is withholding judgment until additional data are obtained. It might be worthwhile to state that the group in the National Foundation will have an opportunity of reporting later before this committee, I believe, about its findings as a result of the studies which I have mentioned here, and with the full approval of the committee on immunization of the National Foundation. To my knowledge after the studies were completed, without exception all of the members agreed that the results were highly significant. Dr. Paul is one of those who believed they were significant.

The CHAIRMAN. Are there any further questions, gentlemen?

You may proceed with your next witness.

I regret the necessity of my leaving at this time, but I had made an engagement to deliver an address many months ago and it turns out to be today.

This is one of the most interesting sessions that our committee has aranged for and you can imagine the great regret that I have that it is necessary for me to leave at this time.

Fortunately, I do have some of your prepared statements and I will be able to keep in touch with some of the testimony that was given.

I have asked Mr. Dolliver of Iowa to proceed during my absence.

I said "Mr. Dolliver." Perhaps, I should have said probably "Dr. Dolliver" in view of his display of knowledge at these hearings.

Mr. DOLLIVER (acting chairman). Dr. Andrews, you may proceed.

Dr. ANDREWS. I have before me, Mr. Dolliver, the press release which was just referred to of the WHO experts meeting in Rome on poliomyelitis and it is available for inclusion in the record if you choose.

Mr. DOLLIVER. It may be inserted in the record unless there is objection.

(Press release follows:)

[News release from Pan American Sanitary Bureau, regional office of the World Health Organization, Washington, D. C., September 22, 1953]

POLIOMYELITIS RECOGNIZED AS A WORLDWIDE DANGER

WHO EXPERTS MEETING IN ROME DRAFT INTERNATIONAL PROGRAM

ROME, September 21.—The first session of the WHO Expert Committee on Poliomyelitis, held under the chairmanship of Dr. John R. Paul of Yale University, took place in Rome from September 14 to 19, attended by scientists from Canada, France, Great Britain, Israel, South Africa, Sweden, and the United States of America.

Recognition that poliomyelitis is a threat of worldwide significance led WHO to call, for the first time, an international group of experts to draft proposals for a worldwide program of research on the polio viruses, and for the development and application of control measures.

The first world program for polio research was outlined in a report developed by the committee. The first step recommended is designation by the WHO of a number of research laboratories in all continents, to work as WHO regional laboratories.

A list of urgent research projects was also drawn up. This list stresses the fact that the paralytic form of the disease is increasing and that "unless effective measures for its control are introduced, it is reasonable to assume that polio will present an increasingly serious problem in almost all countries of the world."

The committee report adds that transformation of the relatively uncommon infantile paralysis of the 19th century into epidemic polio, which is now almost worldwide, is one of the most formidable problems facing public health today. What causes particular concern is the complete failure so far to control the disease.

Commenting on the use of gamma globulin, the committee stated that "its practical application as a prophylactic in polio is greatly limited. The committee condemns its widespread and indiscriminate administration to people who have had no known contact with cases of poliomyelitis."

A more promising method of control is possible by the use of prophylactic vaccines which may become available to health officers in the not too distant future. Vaccination, however, is still in the experimental stage and more research needed, the committee report states. Stressing polio as highly infectious, the experts recommended immediate isolation and quarantine measures for paralytic cases in the communities adding that the restriction of international travel is not justified.

Five recommendations are made to health authorities:

1. Avoid operations including the removal of tonsils and adenoids during an epidemic.

2. The activity of sick people suspected with polio should be restricted for 1 week.

3. Those near polio cases should take a minimum amount of exercise for up to 21 days after exposure and avoid fatigue.

4. Diphtheria and pertussis vaccination should normally continue during the polio season, but not during an epidemic.

5. Avoid the large-scale use of intramuscular injections of an irritant character.

The report goes before the WHO Executive Board next January for approval for publication.

The following experts attended the meeting:

Dr. H. Bernkopf, the Hebrew University, Hadassah Medical School, Jerusalem
Prof. John R. Paul, Yale University School of Medicine, Section of Preventive Medicine, New Haven, Conn.
Prof. P. Lépine, Institut Pasteur, Paris
Dr. F. O. MacCallum, Virus Reference Laboratory, London
Dr. J. H. S. Gear, deputy director, the South African Institute for Medical Research, Johannesburg
Dr. Thomas Francis, Jr., professor of epidemiology, University of Michigan School of Public Health, Ann Arbor, Mich.
Prof. Sven Gard, department of virus research, Karolinska Institutet, Stockholm
Dr. A. J. Rhodes, director of research, the Hospital for Sick Children, Toronto

Dr. ANDREWS. Dr. Stokes has given us the information from the standpoint of a clinician, and a clinician with a strong insight into epidemiology.

We have Dr. Gaylord Anderson here who I think can speak on the same general subject of the scientific background in regard to gamma globulin from the standpoint of a public health educator and teacher.

STATEMENT OF DR. GAYLORD ANDERSON, DIRECTOR, SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF MINNESOTA; PAST PRESIDENT, AMERICAN PUBLIC HEALTH ASSOCIATION

Dr. ANDERSON. Mr. Chairman and members of the committee, Dr. Stokes has referred to some of the laboratory data and some of the field trials which have been developed to test the value of gamma globulin and the idea of protecting against polioymelitis infection through the injection of substances from the blood.

We have known for many years that there was in the blood of those who had recovered from the disease antibodies which would protect the experimental animal against infection. We realized further that not only were these antibodies present in the blood of those who recovered from known disease but also that they were present in essentially equal quantities in the blood of the general adult population. This has been one of the reasons that we have come to the conclusion that the general adult population has had poliomyelitis infection that occurred usually in unrecognized form—the type of infection which I was referring to this morning when I said that the bulk of the population of adult age has had polio and has had it actually three times that we have antibodies against all three types but that we experienced these infections without recognizing them.

So, the idea of finding something in the blood that would protect the individual is not a new one. The new development here has been in terms of the work of the late Dr. Cohn who showed he could concentrate those particular elements of blood and could make them available for injection and that we could get the blood from the general population, rather than solely from those who had had a known attack.

Now, Dr. Stokes has referred also to various studies that were carried on in Utah, in Texas, in Sioux City, Iowa, and over the border into Nebraska, during the summers of 1951 and 1952, and he has pointed out that the attack rate of those who got the gamma globulin was lower than among those who got a control injection of gelatin. I do not believe he added it, but I think it should be added that it was also lower than among those who got no injection of either the gamma globulin or of the gelatin, indicating that among this group who got the injection there was apparently some protection. The exact degree of protection and the exact duration of it might be argued. It has been pointed out by Dr. Stokes that at least some gamma-globulin-injected persons were infected later and that they came out of the experience not only temporarily protected against the paralysis but they had developed their own active immunity as a result of this infection. So what they have demonstrated is that the injection of gamma globulin does not necessarily preclude the possibility of an active immunizing infection. Actually, what happens in an individual case might be one or the other. We do not know. There are a great many more data to be analyzed and I am sure Dr. Stokes would be the first to agree with me that there are a lot more questions that we have to answer with regard to gamma globulin, but they have answered one very important question, and that is that this is not a complete passive protection, but it is enough protection so that the individual exposed at the same time or shortly thereafter is not so likely to have paralysis.

As I pointed out to you this morning, we are not interested basically in trying to prevent infection with polio because this may lead to immunization. We are concerned in trying to prevent paralysis and death from polio. The paralysis and death is the sting of the disease. It has been demonstrated here that, within limits, if we can give gamma globulin to the right individuals, we can protect against the paralytic manifestations of the disease, without at the same time preventing that individual from developing some resistance for later life. That is a highly significant development and adds tremendously to our knowledge of the disease.

There are two basic problems that remain with us. The first comes back to the fact, as was brought out by the chairman, that we do not have all the gamma globulin that we would like; we cannot go in the laboratory and synthetize it. We have to get it from human beings and there is a limited amount we can get. It takes essentially 1 blood donation to protect 1 child and, therefore, we realize that there is a limit to the number of children that we can potentially protect in any 1 year. Our second problem is, given a limited supply, how are we going to use it to the greatest protection of the greatest number of individuals?

Now, if we were able to spot the individual who is going to come down with polio tomorrow or the next week, that would be fine. We could say, "Now, we know you are likely to come down next week and we will give you gamma globulin."

I doubt if there are many persons who would question but what that would be effective and who would not do it that way if they could.

Unfortunately, as I pointed out this morning, the bulk of the cases of polio are unrecognized, and, therefore, most of the persons exposed

to polio did not know it at the time. That differs strikingly from measles, for instance, where the majority of our patients who are ill with it can be recognized; thus we know pretty well who they are. Unfortunately, in polio there is no rash which identifies the infection when it occurs.

Polio would be easier to control if infected persons developed a rash, but they do not, and our problem is to try to find the persons to whom that gamma globulin should be given.

There is a great deal of controversy and difference of opinion—and good intelligent difference of opinion—as to whether the better way to give this limited supply of gamma globulin is to give it to certain persons known to have been exposed, because they are members of a family in which a recognized case has occurred or to give it to all of the children in a community in which there is a high incidence of polio.

We start by taking members of such families because we know that certain other members of the family will come down with polio. The risk in those situations is greater than in the general population. We are trying to take those persons with known exposure, since there is a limit to how far we can go with gamma globulin. Therefore, we have to feel our way along in public health agencies to find out how we can best use this gamma globulin with the limited supply that there is.

The other approach to it has been mass immunization. For instance say this community seems to have more polio than the other. They then give the bulk of the children injections of gamma globulin to prevent an outbreak. That has been tried in a few instances.

You will hear from others some of the results obtained. It would be presumptuous on my part to present the facts and results to you, because there are many data which others have gathered, but I think it is fair to say that when you see these data there will still be reasonable grounds for differences of opinion.

I do not share the feeling that has been expressed in the current issue of Look magazine, the October 20 issue of which is on the newsstands now, containing a bitter attack upon public health agencies, accusing them of having sat on the supply of gamma globulin, letting it gather dust on the shelves of the health departments and charging some of the public health agencies with responsibility for a lot of children getting paralysis because they did not use gamma globulin to the greatest possible extent.

We feel our way along very carefully on programs of this sort, and we would be open to charges of equal neglect if we were to go out and obtain all the gamma globulin we can find and inject it just for the fun of injecting it. Because we do not use it in a situation where somebody thinks it might conceivably be valuable, does not mean that the public health agencies have been derelict in their duty.

All of this means simply that we are still trying to find out a formula for the use of a substance that is very precious, a substance that came out of the veins of human beings, and which can be produced only in the bodies of human beings. Somebody has walked up and given his blood for the protection of somebody else. As health officers we have the responsibility of seeing to it that this blood or its products are not wasted. It is not dereliction of duty to be careful of something as precious as gamma globulin.

Time is going to tell exactly how we are going to make the best use of this material, whether or not to use it in mass inoculation, and what will be the effect of it if we do. Remember that hindsight is always far easier than foresight.

Mr. DOLLIVER. Mr. Heselton.

Mr. HESELTON. Doctor, in connection with this meeting of the WHO Expert Committee on Poliomyelitis in September, I see that the news release contains this paragraph:

> Commenting on the use of gamma globulin, the committee stated that "It's practical application as a prophylactic in polio is greatly limited. The committee condemns its widespread and indiscriminate administration to people who have had no known contact with cases of poliomyelitis."

I, of course, do not know what was in the minds of the experts who authorized that statement. On the other hand, it is difficult for me to believe that they would make such a statement if they had not had evidence of what they called widespread indiscriminate administration to some people.

Is it a fact that there is evidence of such a use anywhere in the world of this substance?

Dr. ANDERSON. To the extent that this statement is put in quotation marks in this news release I assume that is a verbatim statement from that committee report.

Mr. HESELTON. Yes.

Dr. ANDERSON. I would say, speaking as an individual, that I would agree with that particular statement because we have, to my mind, been using gamma globulin for mass programs in cases where I personally would question the desirability of having used gamma globulin.

I referred to an article quite awhile ago about one of the health departments, the Minnesota State Health Department. I have no official working connection with it, though I am chairman of its advisory committee on the problem of polio control in the State of Minnesota.

We discussed this whole question in that committee. We have discussed it repeatedly with the State health department, and we felt that at the present time there was no evidence in some of the areas in Minnesota which were requesting gamma globulin to justify its use. It was used in 2 or 3 counties, and personally I do not believe it was justified in those cases. Considerable pressure was exerted for its use. Somebody might say that it was used to keep the people quiet, but I question that data will come out showing that the polio decline in those counties was in any way attributable to the injections. In 1946 when we had no gamma globulin, polio rose to a peak and then declined in about the same fashion. I cannot say that maybe 1 or 2 or 3 children did get some protection from it, but I do not think we can say that, due to giving it to them, they stopped an outbreak.

Mr. HESELTON. I would like to develop a bit more the situation as it exists today.

How long has gamma globulin been known or in existence?

Dr. ANDERSON. Some 10 or 12 years.

Mr. HESELTON. I assume that the production of it has increased as time has gone on?

Dr. ANDERSON. That is true.

Mr. HESELTON. Who produces it, the private laboratories?

Dr. ANDERSON. It can be produced in private laboratories to the extent that they get blood. I believe Dr. Grant could tell you who does the work for the Red Cross. They gather the blood, and as I recall it, they have had the material processed by some of the private laboratories.

Mr. HESELTON. Is there any other production than by the private pharmaceutical laboratories?

Dr. ANDERSON. By them?

Mr. HESELTON. Any other production except by them.

Dr. ANDERSON. I do not know of any other. Dr. Aufranc says two States are gathering their own blood to produce gamma globulin.

Mr. HESELTON. That is, two State laboratories?

Dr. ANDERSON. Yes.

Mr. HESELTON. Who determines where that product shall go?

Dr. ANDERSON. My understanding has been that it has been distributed under the formula determined by the Office of Defense Mobilization.

Mr. HESELTON. I realize that the Office of Defense Mobilization has announced plans for the distribution of it through State health departments.

Dr. ANDERSON. That is right.

Mr. HESELTON. Over a 5-year period.

Dr. ANDERSON. That is right, based on the amount of polio they had during the previous 5 years.

Mr. HESELTON. The basic calculation is to multiply by 60 percent your average number of cases over a 5-year period.

Let us say that X pharmaceutical concern is producing this product. Are there any conditions surrounding the production of that product that determine its distribution, as to where they can sell it? Can they on their own initiative sell to physicians or to any group or are they compelled to follow a plan of distribution?

Dr. ANDERSON. I know of no law that would compel them to do that if they had gotten the blood.

Mr. HESELTON. In other words, the bulk of the product is subject entirely to the cooperation of private concerns in order to make this particular plan successful?

Dr. ANDERSON. It is my understanding, however, that the national foundation bought up the supply from the private companies and turned it over to this one big pool.

Mr. HESELTON. That still is a matter of voluntary cooperation as far as the pharmaceutical concerns are involved.

Dr. ANDERSON. I do not believe they could have confiscated it. It would have to be voluntary.

Mr. HESELTON. I agree with you. If this is an important development, which we must assume, in the control of poliomyelitis, and if there is a national health interest it may well be that some attention should be given to the possible maldistribution and misuse in terms of what you have testified to and what I presume the other experts agree upon.

Do you know of any distribution to individual physicians?

Dr. ANDERSON. I know of none this past year, this past summer. It has been sold in other years by the drug houses to physicians, but this

past summer, as I understand the situation, it was all put into this one pool to prevent abuse.

Mr. HESELTON. What about those two State laboratories, do they also sell direct to the druggists or do they control their own distribution?

Dr. ANDERSON. I do not know.

Mr. HESELTON. Turning to another phase of what was said at this other meeting yesterday, you brought back to my mind that some suggestion was made that in other countries where sanitation is not as well developed as it is in this country children appeared to build up their own immunity to a greater degree than here and that the use of gamma globulin might conceivably slow down the individual ability to build up immunity. Am I wrong in my recollection?

Dr. ANDERSON. That was a statement of Dr. Ward's which was given in the paper this morning.

Mr. HESELTON. Do you care to comment on that?

Dr. ANDERSON. Yes; I shall be very happy to.

Dr. Ward referred to immunity and poor sanitation. We know that the children in other countries tend to develop antibodies against polio somewhat earlier in life than we do, and that polio in other countries occurs earlier in life. This past winter I was in Egypt, where polio is very rarely seen beyond the age of 3. We have countries in South America, Chile, and Brazil, where polio occurs very early in life. On the other hand we have found it true also that in those same countries diphtheria and scarlet fever occur early in life.

Now, if we use the word 'sanitation" to refer simply to cleanliness, disposal of human wastes, and purity of water supply I would differ from Dr. Ward in attributing this phenomenon as being due to sanitation.

If he refers to the general congestion of the community—regardless of whether an organism spreads from person to person through the respiratory tract or intestinally—which results in the spread of infection by being closely crowded together, if that was his use of the word "sanitation," I would agree with him.

In these countries where people are crowded together under unsanitary conditions, and that includes congestion, dirt, and everything else, in those countries we do have polio occurring earlier in life just the same as the other diseases do. The implication, intentional or unintentional, one might have gotten from the paper this morning, was that this was peculiar to polio and not characteristic of other diseases as well.

Mr. HESELTON. How long does gamma globulin remain effective?

Dr. ANDERSON. That I think is a matter that could be argued a bit. The information that came out from Dr. Hammon's studies in Sioux City last year and elsewhere would suggest that the protection last 2 to 6 weeks.

Mr. HESELTON. I am sorry I did not frame my question better. I assume that there may be some possibility of it, like other substances, deteriorating.

Dr. ANDERSON. You mean how long it lasts in the bottle after it is prepared?

Mr. HESELTON. Yes.

Dr. ANDERSON. I would rather have Dr. Aufranc answer that.

Mr. HESELTON. He will testify later?

Dr. ANDERSON. Yes.

Mr. HESELTON. Then there is one final question.

As I recall it there was an incident in New York City in connection with the use of gamma globulin. There was a march on city hall by masses of people, and there was a release of gamma globulin.

Surely we all understand that any mother with a child wants to protect the child from poliomyelitis, but I wonder if the use of that phrase, "indiscriminate use," might not truly be applied to that sort of incident. Is not that the very thing that your experts in Congress or anywhere else, as well as doctors everywhere who have the responsibility of trying to get the people to understand that this is not available in large quantities, and that it must be used in the most effective way possible in order to protect the largest number of people?

Dr. ANDERSON. Exactly.

Mr. HESELTON. And certainly political pressure should be kept out of it completely.

Dr. ANDERSON. Absolutely. I should say that would have been indiscriminate use of it had they released it just because people said they wanted it.

Mr. DOLLIVER. Mr. Klein.

Mr. KLEIN. Referring to that New York City situation, I happen to know it well. I would agree that it was unfortunate. They, the parents picketed city hall, and, as a matter of fact, some of them stayed in the board of health overnight, but as I recall, one of the reasons given for the gamma globulin not being released at that time was that it was not always effective, that it was not as effective as the public had been led to believe.

As I understand your testimony, Doctor, it is that in all cases it has been able to prevent paralysis?

Dr. ANDERSON. No, sir, not in all cases; no, we have nothing that is a 100 percent preventive. It apparently produced protection in a substantial fraction of those injected, but did not prevent everyone from getting it. Some of those who got gamma globulin came down with polio, especially the first week afterwards, because it was given too late. Even during the 2d to 5th week there were cases of polio among those getting gamma globulin, but they were few in number.

Mr. KLEIN. They were fewer in number?

Dr. ANDERSON. Yes.

Mr. KLEIN. It seems to me that while I would agree with both sides about such indiscriminate use, in New York City it was not used indiscriminately.

As I recall it, this is what happened. At a summer camp 1 or 2 of the children came down with polio, and all they wanted was for those children who had been in that same tent or bunks, or in close contact, to have the gamma globulin. That occurred before they finally got it, after these moves we do not approve of. However, as a result of this publicity, it happened in 2 or 3 other cases.

It seems to me, Doctor, and we all agree that it is a great discovery, and if we had it in sufficient quantities it could and should be administered to almost anybody who had contact with somebody with polio.

Dr. ANDERSON. Yes; if we had it in unlimited quantities, but I call your attention to the fact that by such use we would only be prevent-

ing a small fraction of polio because only a small fraction have had known contacts.

Mr. KLEIN. Where there was a case of a person coming down with polio anybody who had close contact with him could very likely be helped by having gamma globulin administered.

Dr. ANDERSON. Yes, but we have a limited supply, and the question is how far can we spread it out.

In Rochester, Minn., it was found that if you start taking the history of contacts you may wind up with 50 different contacts for one case of polio. If we did it on that basis we would not have had enough gamma globulin by any means.

There are going to be differences of opinion about it. I have had some already with my colleagues in the Minnesota Health Department.

I remember one case where I would have released it, and they thought they could not. They had a good reason why they could not, and I think I had good reasons why they should.

Mr. KLEIN. During this period of hysteria, which is what it was, you could not really blame these parents. I probably got 20 or 30 phone calls about it, and people came over to my home and said, "You have to get this for us; we have to have it. I really tried, but I was unable to get it.

So, I believe that we should let people realize that there is a small quantity of it, that there is not sufficient and that it ought to be retained for those cases in which it would be most effective.

Dr. ANDERSON. I told you this morning about a case of polio which developed in Rochester, Minn., caused cases among visitors from Wisconsin. There is a case where, if we had gamma globulin at that time we would have guarded those children in Wisconsin and they could well have benefited from such an injection.

On the other hand, the minute we start injecting all close contacts we have to define what is "close." Then there are the casual cases. I know of one case of polio in a housing development containing hundreds of children. All the people in the housing development came down to the city hall wanting gamma globulin just because one case occurred among several hundred families in that development.

Mr. KLEIN. Do you envision the time, Doctor, or possibly some of the other members of the panel may be able to answer this, when we will have sufficient gamma globulin so that it can be used by as many people as want it and would like to try it out that way? Is there ever such a time coming?

Dr. ANDERSON. I do not believe so. We would have to bleed all of the persons in the country several times a year to get enough gamma globulin to supply all of the demand if we just did it because the people wanted it.

Mr. KLEIN. This ought to be a good opportunity for the Red Cross to go out to the public and say the only way we can get this is through more people donating blood.

Dr. ANDERSON. I am sure that they have.

Mr. HESELTON. I notice in this tabulation entitled "Summary of Gamma Globulin Mass Prophylaxis Areas," as of October 5, 1953, particularly in Montgomery, Ala., that of those under 10 years of age 32,948 were inoculated; that in Caldwell, N. C., of those under 10 years of age, 12,600 were inoculated; that in Steuben and Chemung, N. Y.,

37,125 under 10 years of age were inoculated; in Catawba, N. C., 14,761 under 10 years of age were inoculated; that in Macon, Ill., among those under 10, 18,000 were inoculated, and in Benton, Minn., among those under 15 years of age, 26,721 were inoculated.

If I understand your thought correctly, your idea is with the limited supply and with the widespread incidence of this disease that it is not the mass inoculation of everyone who lives within a certain geographical distance or area that should be done. The problem is to pick out the selected people in a practical way trying to protect those who have been subject to exposure, such as those youngsters who were in a camp or in a school where there had been polio; is that your thought?

Dr. ANDERSON. Yes, sir; I believe that would be less wasteful of the material.

Mr. HESELTON. This record indicates that somehow or other it has gotten out of hand, and a great deal of very precious material is just dumped on to somebody.

Dr. ANDERSON. There are two schools of thought about that. There is one school that believes it should be limited to known contacts.

There is another that says we know that there are so many unknown contacts that the most effective way is giving it to everybody in communities where there is a lot of polio. That is the attitude which has been taken by the national foundation.

Mr. HESELTON. You say it is up to the national foundation to determine how it should be given out?

Dr. ANDERSON. No, not that it is up to the national foundation to determine that, but it is the opinion of foundation officials that it should be used all over a community where there is a lot of polio. I believe that it should be used for contacts. Dr. Langmuir and his group are carrying on studies about the most suitable way to use it.

Mr. HESELTON. Somebody should have not only some direct opportunity to make the decision, but the responsibility for making it.

Dr. ANDERSON. The recommendation of the committee of the National Research Council was that is be used on contacts. The national foundation did not agree with that and thought it should be used the other way.

I think from the data being assembled we may know who was right—or we may not.

Mr. HESELTON. There were five recommendations made by this WHO expert committee, and the fifth one was:

> Avoid the large-scale use of intramuscular injections of an irritant character.

Dr. ANDERSON. Yes, sir.

Mr. HESELTON. Is that something in connection with the treatment of poliomyelitis or something apart from it?

Dr. ANDERSON. Apart from it.

The evidence has shown that children who have been immunized against diphtheria or certain other diseases, and who happen to come down with polio during the following month, seem to have a localization of the paralysis in the extremity into which the immunizing injection was given. There is some reason to think that the polio may be a little more severe. They are talking about an irritant substance there that might tip the scale into producing a little more severe form of polio.

Mr. HESELTON. I notice the first recommendation is:

Avoid operations, including the removal of tonsils and adenoids, during an epidemic.

Dr. ANDERSON. The removal of tonsils and adenoids should be done later instead of during a polio outbreak. Children developing polio are likely to have more severe cases if the surgery is done during the incubation of the disease.

Mr. DOLLIVER. Mr. Carlyle.

Mr. CARLYLE. Doctor, I have gained the impression that gamma globulin serves a twofold purpose, one of which is in many instances to prevent infection.

Dr. ANDERSON. That is one possibility.

Mr. CARLYLE. And then to lessen the effect in the event of infection?

Dr. ANDERSON. I would say preferably not to lessen the severity, but so that a person would have a lighter form of the disease rather than a paralytic form.

Mr. CARLYLE. That would be the primary purpose?

Dr. ANDERSON. Yes, that would be the primary purpose.

Mr. CARLYLE. Has it been found to be helpful in preventing infection?

Dr. ANDERSON. That we still do not know. We have evidence that some of those persons who had gamma globulin had been infected in the meantime and went through it without paralysis.

Mr. CARLYLE. Is this a preparation or medicine that will keep?

Dr. ANDERSON. Dr. Grant could tell you that. As to the exact life span of it I would rather have him tell you.

Mr. CARLYLE. Is it always administered by injection?

Dr. ANDERSON. Yes, it is.

Mr. CARLYLE. That is all.

Mr. DOLLIVER. Are there any further questions, gentlemen? You may continue, Doctor.

Dr. ANDREWS. In our discussion of the use of gamma globulin it is unfortunate that representatives of the National Foundation for Infantile Paralysis are not present. The foundation was committed previously for this day because of its annual deliberations in another meeting being held in West Virginia. However, on the 12th of the month, I am sure you can get satisfactory answers regarding the questions which this testimony raises, from representatives of the national foundation.

It is also too bad that Dr. Robert Korns, State epidemiologist of the New York State Board of Health, and who had a great deal to do with the issue Mr. Klein raises is not here to give you a firsthand authoritative account of that because he was right in the thick of it. I personally invited his testimony because I know he could give us a great deal of information about this problem.

It has been emphasized that gamma globulin comes from human blood; thus the business of getting this basic raw material is extremely important. So, we have asked General Grant, who was air surgeon in the Air Force during the last World War, to tell us something about the operations of and the interests of the American Red Cross in obtaining blood and processing it for gamma globulin.

Mr. DOLLIVER. Dr. Grant.

STATEMENT OF DR. DAVID N. W. GRANT, DIRECTOR, AMERICAN NATIONAL RED CROSS BLOOD PROGRAM

Dr. GRANT. Mr. Chairman, and members of the committee, I have put this on paper just to shorten it and so as not to miss anything. I will be glad to answer any questions involved.

In February 1941, the American National Red Cross, on the request of the Surgeons General of the Army and Navy, established facilities for the collection of blood for the Armed Forces. In slightly more than 4½ years, the program collected and turned over to the Armed Forces 13,326,242 units of blood. The majority of this blood was converted into dried plasma and serum albumin by the Armed Forces. The total Red Cross expenditures for the operation of this blood donor service approximated $15,870,000, exclusive of the cost to the cooperating Red Cross chapters.

Now, after the program to provide serum albumin to the Army and Navy was well under way, it became evident that other fractions of plasma proteins would accumulate that would be surplus to the needs of the armed services. The first of these fractions found to be clinically useful was the immune serum globulin which was shown to be very effective in the prevention or modification of measles. Measles was not a major public health program to the armed services, and the crude globulin began to accumulate in large amounts, presenting a storage problem.

After extensive discussion by all concerned, a plan in 1944 was developed whereby surplus immune serum globulin would be returned to the Red Cross who would then distribute it to civilians in this country without charge for the product. This was legally made possible by the passage of Public Law No. 457 of the 78th Congress, approved October 5, 1944. Section II (f) reads as follows:

> No surplus property which was processed, produced, or donated by the American Red Cross for any Government agency shall be disposed of except after notice to and consultation with the American Red Cross. All or any portion of such property may be donated to the American Red Cross, upon its request, solely for charitable purposes.

At the end of World War II the armed services had a large stock of dried plasma and serum albumin on hand, which became surplus only because of the sudden termination of the war in the Pacific.

At this time approximately 5 million packages of surplus dried plasma were turned over to the Red Cross by the Army and Navy, for use in civilian medical practice, without charge for the product. Three million one hundred seventy-two thousand three hundred forty-one packages of this material in the dried plasma state were issued to licensed physicians and acceptable hospitals; 1,772,378 packages were fractionated into serum albumin and gamma globulin. The last of this surplus was put into fractionation in the fiscal year 1950–51. This project cost the Red Cross $7,099,660.36.

Because this surplus material had been frationated by the Red Cross, it was possible in the fall of 1950 to provide, without cost, 80,000 units of serum albumin to the Department of Defense for use in Korea. The gamma globulin obtained through this project and that fractionated from outdated blood from the Red Cross regional

programs as of December 31, 1952, amounted to approximately 9,384,636 cc's, which were distributed as follows:

	Cubic centimeters
To State health officers	8,264,636
To polio foundation for experiments in Utah, Texas, and Iowa	260,000
Total	8,524,636
Balance on hand Jan. 1, 1953	860,000
Grand total	9,384,636

In December 1952, the Red Cross was requested by the Office of Defense Mobilization to accept the responsibility for providing the maximum amount of gamma globulin possible to meet the minimal epidemic need for poliomyelitis during the summer of 1953.

The Red Cross accepted the responsibility of obtaining the maximum amount of gamma globulin possible within the limits of available fractionation capacity of whole blood, for the calendar year 1953, and, further, to process and package any crude gamma globulin that might be released by the Department of Defense.

Arrangements were made with the Department of Defense so that a portion of the blood being collected for that Department would be fractionated, the Defense Department to retain the serum albumin, the Red Cross to obtain the gamma globulin by paying a proportionate share of the cost of fractionation. In addition, the Navy Department out of World War II surplus turned over sufficient bulk material for 2 million cc's of the finished product, the Red Cross paying the cost of processing, testing, and packaging.

All the gamma globulin in the custody of the Red Cross on January 1, 1953, and that obtained during the calendar year 1953 has been or will be turned over to the Office of Defense Mobilization for distribution. The Red Cross is paying all shipping charges connected with its distribution to State and Territorial health officers. It is estimated that during the calendar year 1953 the Red Cross will have furnished the Office of Defense Mobilization approximately 9,658,336 cc's of finished immune serum globulin at a cost of $4,300,000 for the calendar year.

From the Red Cross viewpoint, it is unfortunate that the above-mentioned section of Public Law 457 of the 78th Congress was not included in the present surplus property law.

The present law does not provide that surplus property can be turned over to the Red Cross, even though the material was obtained or donated by the Red Cross. This will create a serious public relations problem for the Government and the Red Cross if surplus material of this character reaches the open market, and I hope Congress will reinstate the previous statute.

Mr. DOLLIVER. Are there any questions, gentlemen?

Mr. HESELTON. Doctor, do you know whether the Armed Forces discontinued the use of plasma for the men in Korea this last spring?

Dr. GRANT. I could not answer that, sir.

I know that they are fractionating their stock into serum albumin now.

Mr. HESELTON. To your knowledge has any controversy existed as to whether in the preparation of gamma globulin from blood plasma there is possibly a carryover of yellow jaundice?

Dr. GRANT. Certainly not to my knowledge, and I think Dr. Stokes could answer that. Maybe he could answer; I know of no case.

Dr. STOKES. As far as I know there has been only one possible case. That occurred in England as a result of processing blood plasma that was highly infected. In a group of infants who received infected plasma, about 60 percent, it is my recollection, or even more, developed jaundice.

When that same plasma was processed into gamma globulin and injected there was only one case and, in the estimation of the individuals who did the study, they thought that was a chance case. In other words, the processing of the gamma globulin plasma appeared to have destroyed the virus.

In all those injections of gamma globulin we have given for measles, and for epidemic jaundice to prevent those two diseases, and also in poliomyelitis there has been no evidence of gamma globulin producing jaundice.

Mr. HESELTON. Do you know whether there was any decision made by the Armed Forces to abandon the use of it in Korea?

Dr. STOKES. Gamma globulin or plasma?

Mr. HESELTON. Blood plasma.

Dr. STOKES. I believe the plasma was.

Mr. HESELTON. Do you know why?

Dr. STOKES. I am not absolutely certain of that, sir.

Mr. HESELTON. Who would be certain, the Surgeon General or the Secretary of Defense?

Dr. STOKES. The Surgeon General's office is the best one to ask about that.

Mr. DOLLIVER. Mr. Priest.

Mr. PRIEST. Mr. Chairman, I have one question.

Dr. Grant, can dried blood plasma be reprocessed in such a way as to obtain gamma globulin?

Dr. GRANT. You take dried plasma and you can fractionate that into serum albumin and the globulin.

Mr. PRIEST. You could do that after it has been dried.

Dr. GRANT. That is being done now.

Mr. PRIEST. It is being done now?

Dr. GRANT. Yes.

Mr. PRIEST. That is the only question I have at this time.

Mr. DOLLIVER. Mr. Klein.

Mr. KLEIN. Can you tell us about how long this remains effective, in other words, before it is used?

Dr. GRANT. I think it is an arbitrary date I might state, but we have a 2-year period on it after which we take it and rework it. That is, of course, a rather expensive operation. It is in vials and we have to take it out and rework it.

Mr. KLEIN. It lasts 2 years?

Dr. GRANT. Yes, 2 years; we reprocess it after 2 years.

Mr. KLEIN. That is all.

Mr. DOLLIVER. Dr. Andrews?

Dr. ANDREWS. I think perhaps some of the answers to Mr. Heselton's questions may present themselves in this next testimony by Dr. Aufranc.

STATEMENT OF DR. W. H. AUFRANC, DIRECTOR, HEALTH RESOURCES STAFF, OFFICE OF DEFENSE MOBILIZATION, WASHINGTON, D. C.

Dr. AUFRANC. Mr. Chairman and members of the committee, with your permission I would like to read my statement.

Since December 1951, the development and coordination of a national blood program have been the responsibility of the Office of Defense Mobilization through its Health Resources Advisory Committee and Subcommittee on Blood. At that time the world emergency made it urgent to establish a single authority for coordinating and allocating the defense blood needs of the country. The Department of Defense and the Federal Civil Defense Administration had both requested the American Red Cross to collect blood to fill their individual requirements. These needs had to be superimposed on the already existing civilian programs of the American Red Cross and independent blood banks. Therefore, in order to avoid duplication, the national blood program immediately set up priorities and undertook a coordinated program to provide sufficient blood and blood derivatives to meet the basic military, civilian, and civil defense requirements in the mobilization effort.

Early in 1952 the Health Resources Advisory Committee examined a new development of the use of gamma globulin as a prophylactic agent against paralytic poliomyelitis. As this product is an important fraction of human blood, it became obvious that the actual value of gamma globulin in poliomyelitis had to be determined more definitely in order to appraise the effect on the national blood program efforts.

In order to evaluate the problem properly, the Subcommittee on Blood initiated a series of meetings to review the scientific findings. Consideration was also given to the Armed Forces requirements for gamma globulin, the gamma globulin production potential in the United States, and the adequacy of the blood-collection program to meet a possible additional requirement for blood.

The first of these meetings was called by the Subcommittee on Blood in Boston, Mass., in April 1952, and subsequent discussions and conferences were held during the next few months with representatives of the following groups:

The National Foundation for Infantile Paralysis.

The American Medical Association.

The Association of State and Territorial Health Officers.

The Public Health Service.

The American National Red Cross.

The National Research Council, and a representative of the Health Resources Advisory Committee, Office of Defense Mobilization.

It was the consensus of those participating in the first meeting that the early scientific studies on the use of gamma globulin were inconclusive and that a statement to this effect should be obtained from Dr. William McD. Hammon, University of Pittsburgh, who had conducted the studies. This action was carried out, and the statement, including a report on the existing status of the studies, was released to the interested agencies. It is felt that this procedure served the

useful purpose of forestalling any undue public demand for gamma globulin for the 1952 polio season.

In July 1952, the National Research Council was requested, in its advisory capacity to the national blood program, to undertake an overall study of the problem and to report its findings to the Office of Defense Mobilization. In connection with this request the Subcommittee on Blood and its staff worked closely with the council, making available to it all the factual material and opinions that had been developed to date.

The council was specifically requested to consider and advise on the following items:

1. An assessment of the current stockpile and production of gamma globulin.
2. The necessity of allocating supplies; and, if so, when.
3. The priorities and machinery needed for allocation if and when it should be required.

After study of all available data the National Research Council submitted a letter of recommendation in October 1952, to the Chairman of the Subcommittee on Blood embodying the following major points:

1. That the preliminary scientific evidence to date indicated that the administration of gamma globulin had limited prophylactic value from the end of the first week through the fifth week after its injection.
2. That from a scientific viewpoint gamma globulin did not offer a practical solution to the problem of preventing paralytic poliomyelitis.
3. That from a practical viewpoint every reasonable effort should be made to provide adequate amounts of gamma globulin for minimal epidemic needs for the 1953 poliomyelitis season.
4. Attention was also called to the fact that the current production of gamma globulin was but a small fraction of the potential needs estimated for poliomyelitis alone.

In October 1952, at the annual meeting of the American Public Health Association, official announcement was made by Dr. Hammon of the findings of his studies of the efficacy of gamma globulin in the prevention of paralytic poliomyelitis. It was apparent then that some definite action would have to be taken in view of the short supply of gamma globulin.

Early in November 1952 the Health Resources Advisory Committee and its Subcommittee on Blood considered the recommendations of the National Research Council and concurred in their findings. Immediate consideration was given to the course of action needed at that time.

It was realized that not even the full capacity of the Nation's blood fractionation laboratories could produce sufficient gamma globulin for both measles and poliomyelitis during the 1953 season. This problem and its potential impact on the national blood program were thoroughly discussed with appropriate officials of the Department of Defense, the Federal Civil Defense Administration, the Public Health Service, the National Foundation for Infantile Paralysis, the National Research Council, and the American National Red Cross. It was their unanimous opinion that the maximal production capacity for gamma globulin must be achieved in order to meet the minimal needs for poliomyelitis during 1953 and to prepare for the year 1954.

Increasing the supply of gamma globulin was given immediate consideration. Upon the advice of the Health Resources Advisory Committee, the Office of Defense Mobilization requested the American National Red Cross to accept the additional responsibility of providing the maximum amount of gamma globulin possible for the prevention of poliomyelitis.

On November 24, 1952, the Board of Governors of the American National Red Cross accepted this request in principle with the proviso that all gamma globulin provided by the Red Cross for this purpose be turned over for allocation and distribution to an agency designated by the Office of Defense Mobilization.

Shortly after this action the National Foundation for Infantile Paralysis advised the Chairman of the Health Resources Advisory Committee of its willingness to purchase the available inventory and future production of gamma globulin from commercial pharmaceutical houses and to turn this supply into a common pool. Discussions and consultations were held with the producers of gamma globulin in order to solicit their advice on the complex distribution problem of both commercial and Red Cross gamma globulin.

In view of the interest of the American National Red Cross and the National Foundation for Infantile Paralysis and other groups working in the blood program, the health resources representatives of the Office of Defense Mobilization continued to work with the special panel of experts in public health, epidemiology, and poliomyelitis, established by the National Research Council to develop a suitable allocation plan. This group, after a thorough consideration of all the problems, was in general agreement that the equitable and effective use of available supplies of gamma globulin could be achieved only by the adoption of a plan permitting equitable distribution. In February 1953 the National Research Council submitted a distribution plan to the Health Resources Advisory Committee.

Upon the advice of this Committee and its Subcommittee on Blood, the Office of Defense Mobilization on February 4, 1953, assumed the responsibility for coordinating the distribution of supplies of gamma globulin made available for that purpose by the American National Red Cross, the National Foundation for Infantile Paralysis, and any other source. It directed the Chairman of the Health Resources Advisory Committee to establish an effective mechanism to carry out that responsibility.

On April 9, the Health Resources Advisory Committee approved the allocation plan in principle, proposed by the National Research Council. The plan as approved by the Health Resources Advisory Committee and subsequently released to all State health officers embodies the following major features:

1. That the State health officers have full responsibility for distribution of the gamma globulin allocated to them.

2. That gamma globulin would be allocated for the control of measles and other diseases.

3. That approximately 57 percent of the total supply estimated to be available for poliomyelitis would be distributed in a predetermined fashion based on the States past and current experiences with poliomyelitis.

4. That approximately 33 percent of the total would be retained in the common pool for mass community prophylaxis upon application of States having serious epidemic situations.

5. That an additional 10 percent would be retained for unusual or special situations, for emergency distribution and for special investigations.

6. The plan also suggested methods for use of the gamma globulin allocated to States as follows:

(a) Mass prophylaxis—for use on a communitywide basis among the age groups of children experiencing unusually high epidemic rates.

(b) Household contacts of clinically diagnosed cases.

(c) Other intimate contacts of clinically diagnosed cases.

(d) Household contacts of suspected cases.

It was further recommended that the details of the plan be made widely known to the medical and public-health professions.

The National Research Council prepared an informative statement on The Distribution and Use of Gamma Globulin which was made available to State health officers for their use.

The distribution plan having been adopted, the Office of Defense Mobilization delegated the operational responsibility to the United States Department of Health, Education, and Welfare.

Since that time the Health Resources Advisory Committee has received periodic reports on the progress of the gamma globulin distribution program, and the Health Resources staff has given such assistance as has been necessary with respect to policy interpretation of the initial plan.

The Health Resources Advisory Committee and its Subcommittee on Blood will continue to review the operational aspects of the current plan during the remainder of the year. They will also consider at an early date the need for a distribution plan in 1954, and if necessary will develop one suitable for next year's problems.

In this planning for the future need, the Office of Defense Mobilization will depend largely on the advice and recommendations of the United States Department of Health, Education, and Welfare (Public Health Service) as it will have had the basic operational experience on which to formulate judgment with respect to the needs of 1954.

The Office of Defense Mobilization has been highly pleased with the manner in which the Department of Health, Education, and Welfare has handled the distribution problem. Considering the potential emotional impact connected with as serious a disease as poliomyelitis and the nationwide scope of the problem, the administration of this scarce product has been remarkably free of criticism. The development of the initial distribution plan and the many steps that had to be taken to put it into operation were achieved by the extensive assistance and sympathetic cooperation of all agencies concerned.

It is the earnest hope of the Office of Defense Mobilization that this interim measure of allocation of gamma globulin may soon give way to the development of a suitable vaccine for poliomyelitis.

Mr. DOLLIVER. Any questions, gentlemen?

Mr. HESELTON. Mr. Chairman.

Mr. DOLLIVER. Mr. Heselton.

Mr. HESELTON. I believe either you or Dr. Grant indicated you would answer some question I raised earlier.

Dr. AUFRANC. There are 2 questions you asked, 1 of which I think was partially answered by Dr. Grant. The dating period of gamma globulin is approximately 2 years.

Mr. HESELTON. Yes.

Dr. AUFRANC. The other is with respect to two States producing gamma globulin and the manner in which they distribute it.

They agreed early in the game, so to speak, to distribute their product in accordance with the general plan fitted into their State plan. We made no further voluntary agreement with them than just that.

Mr. HESELTON. What is the dose of gamma globulin that is given for poliomyelitis?

Dr. AUFRANC. For poliomyelitis—and I may be corrected—it is 0.14 cubic centimeter per pound of body weight.

Mr. HESELTON. Fourteen pints of blood for each dose?

Dr. AUFRANC. 0.14 cubic centimeter per pound of body weight. I think someone indicated it took approximately 1 pint to make 7 cubic centimeters.

Mr. HESELTON. I assume from the testimony that you were not able to reach the goal which was set for the production for poliomyelitis this year of gamma globulin?

Dr. AUFRANC. We were unable even to reach the estimated production on time. When the plan was being considered we estimated there would be something less than 1 million doses available during the 1953 calendar year. We had hoped most of that would be available before the peak of the polio season. It did not quite turn out that way.

Mr. HESELTON. Beyond the question of the amount of human blood available, is there any question about the capacity of the laboratories to produce?

Dr. AUFRANC. There was a limitation on the capacity. At the beginning of the program there were only about four companies, as I recall it, manufacturing gamma globulin. Consideration was given to new capacity and discarded because of the time required and because of the fact that this is an interim measure which is quite costly. Our final recommendations were that we expand and run the present capacity around the clock, adding such new equipment as we could to existing capacity. Those were our recommendations.

Mr. HESELTON. There is sufficient actual capacity to produce in terms of the amount of blood that is available?

Dr. AUFRANC. At the present time I would say "Yes"; with Dr. Grant's correction.

Mr. HESELTON. How much does a unit cost?

Dr. AUFRANC. I do not have the cost information. The Red Cross and others purchased the material.

Mr. HESELTON. Do you know, Doctor?

Dr. GRANT. Mr. Chairman, may I answer that question?

Mr. DOLLIVER. Yes, sir.

Dr. GRANT. In considering the cost you have to consider the cost of collection of blood, which, throughout the country, from the Red Cross standpoint, is averaging about $5 a pint to collect it. That is the bottles, the material, the personnel, and so on.

Now, we figure, 4.3 pints of blood to make one unit of serum albumin, which is one shock unit. From that we get one gram of gamma globulin for each pint of blood.

In other words, out of 1 unit of serum albumin we get approximately 4 grams of the gamma globulin, and that gives you 20 cubic centimeters of gamma globulin, which would give you 2 average 10-cubic-centimeter doses.

The cost of that, with the collecting of the blood and everything, is approximately $43 for the whole process.

Mr. HESELTON. $43 for what?

Dr. GRANT. For the whole process; collecting the blood and fractionating it.

Mr. HESELTON. Per unit, or per two units?

Dr. GRANT. For two 10-cubic-centimeter doses of gamma globulin; but you have your byproduct of the serum albumin; one unit of the serum albumin for that. The serum albumin is figured to cost about $26, and the balance of it is the cost of the gamma globulin.

Mr. HESELTON. Then the matter of added funds is not involved here?

Dr. GRANT. I would not say that. The Red Cross is spending funds pretty freely on this, sir.

Mr. DOLIVER. Any other questions?

Mr. KLEIN. I have just one question. I understood you to say, Doctor, that the national foundation had agreed to purchase all of the gamma globulin from the private pharmaceutical companies. Does that mean at the present time there is none privately available?

Dr. GRANT. May I answer that?

Mr. KLEIN. Surely.

Dr. GRANT. I do not think it has been brought out that there are two sources of gamma globulin from the blood field. One of them is whole blood, in which we get the serum albumin and the gamma globulin. The other is the placenta or afterbirth.

Now, the majority of the commercial gamma globulin available to the polio foundation was made out of the placentas. There is very little commercial production out of the whole blood.

Mr. KLEIN. Now, could you go further and answer this: Are they still doing that? Are they still collecting it?

Dr. GRANT. They are collecting placentas, yes, and they are fractionating the blood that they get from these placentas into the gamma globulin alone. They are not producing serum albumin.

Mr. KLEIN. What do they do with the gamma globulin?

Dr. GRANT. They have sold it to the polio foundation.

Mr. KLEIN. What I want to bring out is that a person could not go into a private company and buy some of that on his own?

Dr. GRANT. They could not, just by agreement of the companies not to do it.

Mr. KLEIN. That is what I meant. The companies are all turning it over and it is being distributed?

Dr. GRANT. Yes. The polio foundation is buying that supply.

Mr. KLEIN. Thank you.

Mr. DOLLIVER. Any other questions?

Mr. THORNBERRY. About this collection and distribution and about some criticism being offered about it, is that because the local State health department released it? I cannot tell from the testimony

here, and I do not mean to judge; but I just wonder, where the disagreement is in the open, about whether or not that was the cause. Was it a question of whether it should be released by the State agency?

Dr. AUFRANC. I am not sure of the cause for local criticism or complaint, but the judgment with respect to whether you release it not was the prerogative of the local health officer.

Mr. THORNBERRY. I agree with that.

Mr. DOLLIVER. It has been suggested here on the rostrum that we take a seventh-inning stretch, so we will adjourn for 5 minutes for a recess and reassemble at 5 minutes to 4.

(Thereupon, a short recess was taken.)

Mr. DOLLIVER. We will resume our hearings.

Dr. ANDREWS. Mr. Chairman and members, you have been told something about the nature of gamma globulin, what it can do, why it has been used against polio, how it is obtained, and the basic arrangements which are made for the distribution of this scant but very precious material during this last season of poliomyelitis. The actual mechanics of that distribution at the Federal level are in the hands of the Public Health Service, Department of Health, Education, and Welfare. Dr. Ralph Paffenbarger will tell you something of the details of that plan and the operation of it.

STATEMENT OF DR. RALPH S. PAFFENBARGER, DIVISION OF CIVILIAN HEALTH REQUIREMENTS, OFFICE OF THE SURGEON GENERAL, PUBLIC HEALTH SERVICE

Dr. PAFFENBARGER. Mr. Chairman and members of the committee, in accordance with the regulations which were adopted by the Office of Defense Mobilization the Public Health Service has been distributing gamma globulin for the prophylaxis of poliomyelitis in three different patterns.

In the first place, 57 percent of the total amount expected to be made available, which comes to approximately 3.9 million milliliters or cubic centimeters, is being made available to the States and Territories for their individual purposes.

Secondly, 33 percent of this same quantity—that is, of the total amount expected to be made available during 1953—is being retained by the Public Health Service and issued to counties with particularly high incidence.

Mr. DOLLIVER. Is that directly from the Public Health Service to the individual county, bypassing the State?

Dr. PAFFENBARGER. No, sir. The requests are made by the States to go to a county which is eligible. It is by that channel. The quantity that is being distributed to counties of high incidence is estimated to be approximately 2.3 million milliliters.

The third method in which gamma globulin is being distributed is for special investigations and for emergency purposes, and a contingency fund which represents 10 percent of the total amount of material estimated to be produced in 1953 is being retained in a national pool for those purposes.

Now, with respect to the amount of material which is being made available to the States and Territories, the 57-percent portion, or the estimated 3.9 million milliliters, a basic alllocation was made initially to 52 States and Territories. The basic allocation was computed as a

product of 60 milliliters times the mean number of cases that each State and Territory reported to the National Office of Vital Statistics in the 5-year period from 1947 through 1951.

As soon as gamma globulin was produced—that is, as soon as it was fractionated and tested for type 2 poliomyelitis antibody and approved for release—it was sent out to the States. The first portion of the basic allocation was made available to States on approximately May 15. It was not until that period that material was available for release.

At that time roughly 10 percent of the cases in any calendar year have been reported—that is, by May 15 approximately 10 percent of the cases in the United States have occurred.

The initial allocations were made to the States with the highest seasonal incidence, and all of the basic allocations were made by June 25.

Thereafter, a series of additional allocations have been made, and they have been made after taking into consideration the basic allocations previously made, the total number of cases that have been reported between the 20th and the 36th calendar week, plus the total number of cases expected to occur in the rest of the calendar year.

The general objective has been to get into the hands of each of these 52 States and Territories the same amount of material per reported case by the end of the year. As of this time approximately 130 milliliters per reported case have been made available to the States. Not all of that material has been called for, but it is available to the various States and Territories.

With regard to the 33 percent, or the 2.3 million milliliters, which is being distributed this summer, allocations have been made to high-incidence counties after taking into consideration a so-called "critical poliomyelitis incidence." This was derived from a formula which took into consideration 3 factors, 2 of which are variables and 1 of which is a relative constant.

The two variables are the estimated number of cases to occur in the country this year; and, secondly, the expected amount of material to be made available for mass prophylaxis purposes. The relative constant considered is the number of children less than 15 years of age residing in the United States.

This critical poliomyelitis incidence is not a constant figure. It has been changed at approximately biweekly intervals. As material is sent out to a county of high incidence, the national supply is decreased, thus raising the level of the critical polio incidence, which makes it more difficult for high-incidence counties to qualify for an allocation of this type.

Any county to qualify must meet four requirements. The first is that at the time of their request—the request, as you have said, sir, being made by the State health officer—the county must have had five poliomyelitis cases which occurred since March 28. Secondly, they must be expected to have a total of 20 cases by the end of the calendar year. Third, they must equal or exceed this critical polio incidence. And, lastly, they must show a rising weekly trend. In other words, any county which has a high incidence above the critical polio incidence would be disqualified from consideration if in successive weeks they had a smaller number of cases. If they went 10, 8, 6 they would not be eligible. If they went 6, 8, 10 they would meet that criterion of eligibility.

Thus far allocations for mass prophylaxis have been made to 22 different counties and the District of Juneau, Alaska. Approximately 1.6 million milliliters have been used for this purpose, and close to 226,000 children have received gamma globulin in one of these mass prophylaxis areas.

Quite recently through a special grant from the National Foundation for Infantile Paralysis an extra 2¼ million milliliters was added to the national pool for this particular purpose, and fairly large quantities ar available today to any county which meets the four requirements that I mentioned.

The last method in which gamma globulin is being distributed today is directly from the contingency fund, which represents 10 percent of the expected total amount to be made available. From that contingency fund approximately 5,000 milliliters have been provided to the Department of State for use by Americans who are living abroad.

Also from that fund 22,000 milliliters have been dispatched to 8 different investigators for special projects. Three of these projects are actually field studies to substantiate and to extend some of the findings of Dr. Hammon last summer. And five of the research projects in progress have to do with clinical laboratory investigations on basic research using animals.

Mr. HESELTON. Mr. Chairman?

Mr. DOLLIVER. Mr. Heselton.

Mr. HESELTON. Where were the 22 counties who received the mass quantities?

Dr. PAFFENBARGER. The 22 counties in the order of their approval and in the order of their programs——

Mr. HESELTON. Have you a record of them in the statement?

Dr. PAFFENBARGER. Yes, sir.

Mr. HESELTON. That is all right. That will go in the record.

Mr. DOLLIVER. Yes.

Dr. PAFFENBARGER. Very good.

Mr. HESELTON. Are there any criteria either suggested or required so far as the State health officers are concerned in disposing of the gamma globulin that is assigned to them?

Dr. PAFFENBARGER. The State health officer is given the privilege of using gamma globulin as he sees fit. He is privileged to use material provided him for the immunization of household contacts, or he could use quantities in certain areas of high incidence; for example, in a city or in a certain residential section of a city, at a time of outbreak.

Mr. HESELTON. How has it worked out? Has it developed a good experience, or are there weak spots in it?

Dr. PAFFENBARGER. I am sorry, sir.

Mr. HESELTON. How has this method of individual distribution been developed on the State level? Is it satisfactory or weak?

Dr. PAFFENBARGER. From our standpoint it has been a surprisingly effective method of distributing gamma globulin. From the standpoint of the uses to which the material has been put, I think perhaps Dr. Norton would do better in answering that question.

Mr. HESELTON. I had in mind the fact that the instances I read from somebody's statement shows a very heavy use of it in certain areas. It went into thousands of instances. The colloquy with my colleague, Mr. Klein, was as to whether there should be a limited use

rather than a communitywide use or a geographical-area use, and whether it would be more effective in view of the limited amount available.

Dr. PAFFENBARGER. Well, it is still a moot point as to which is the more effective manner in which gamma globulin can be used; that is, whether it is more effective to use it in the household or the familial contacts of diagnosed cases or whether use in an area of high incidence where all children of a susceptible age group are inoculated. The evidence is just not available to say one is a more effective mechanism than the other.

Mr. HESELTON. I take it the very fact that 33 percent of the total supply was made available under the rules that were drawn up for mass prophylaxis indicates that those who had to do with drawing up that sort of a plan or program were rather sold on the idea of the effectiveness of mass prophylaxis.

Dr. PAFFENBARGER. That appears to be the case; yes, sir.

Mr. HESELTON. That is all, Mr. Chairman.

(The prepared statement of Dr. Paffenbarger follows:)

GAMMA GLOBULIN IN THE PROPHYLAXIS OF POLIOMYELITIS

(Prepared for Hearing of the House Committee on Interstate and Foreign Commerce, Tuesday, October 6, 1953, by the United States Department of Health, Education, and Welfare, Public Health Service, Division of Civilian Health Requirements, Office of the Surgeon General, Washington, D. C.)

POLIOMYELITIS—GAMMA GLOBULIN DISTRIBUTION ACTIVITIES, DIVISION OF CIVILIAN HEALTH REQUIREMENTS, 1953

Early in 1953, the Office of Defense Mobilization delegated to the Department of Health, Education, and Welfare the responsibility of distributing gamma globulin preparations in accordance with plans promulgated by that Office. The Department is discharging that responsibility through the United States Public Health Service which possesses the technical competence and professional liaison relationships essential to perform such tasks.

Regulations of the Office of Defense Mobilization governing the distribution of gamma globulin for the prophylaxis of poliomyelitis dictate that:

(1) Fifty-seven percent of the available supply (an estimated 3.9 million milliliters) be provided the States and Territories for their individual purposes;

(2) Thirty-three percent (an estimated 2.3 million milliliters) be issued by the distribution authority [Public Health Service] for mass immunization programs in counties with high incidence; and

(3) Ten percent (an estimated 0.6 million milliliters) be reserved in the national pool for emergency situations and special investigations.

1. The supply to be provided the States and Territories (the estimated 3.9 million milliliters portion) was subdivided into 3 categories:

(*a*) A basic allocation was distributed to each State or Territory as a quantity of gamma globulin computed as the product of 60 milliliters and its average number of cases reported annually to the National Office of Vital Statistics in the 5-year period, 1947–51. The sum of these basic allocations amounted to more than 1.7 million milliliters and was distributed as rapidly as it was fractionated, tested for type II poliomyelitis antibody, and approved for release. The States experiencing an early seasonal incidence were the first to receive this allocation in toto, and all basic allocations were completed on June 25, 1953.

(*b*) An additional allocation was made available to the 35 States and Territories with the greatest need as computed from a formula which considered:

(i) The quantity of gamma globulin available for these allocations;

(ii) The basic allocations already issued; and

(iii) The cumulative number of poliomyelitis cases for each State and Territory reported from the 20th through the 30th calendar week (the 20th week was the first period during which gamma globulin was available for use, and the 30th week was the time of the additional allocations).

The States and Territories which were not offered an additional allocation had received a proportionally large basic allocation in relationship to the number of cases occurring during the interval concerned.

(c) Forty-seven of the States and Territories have been notified of revised additional allocations to be made to them upon request during the balance of 1953. Somewhat more than 2.8 million milliliters of gamma globulin will be provided over appropriately spaced intervals in a manner which takes the following factors into consideration:

(i) The quantity of gamma globulin on hand and that estimated to be available by the end of 1953 for these allocations;

(ii) The quantity of material previously received by each State and Territory, through basic and additional allocations; and

(iii) Each State and Territory's proportion of the Nation's cases reported from the 20th through the 36th calendar week and those expected during the balance of the year.

As of October 2, approximately 0.5 million milliliters have been distributed to States as additional allocations. Table I presents the quality of gamma globulin made available, and the number of poliomyelitis cases reported from the 20th through the 38th calendar week.

2. The 2.3 million milliliters portion of gamma globulin expected to be made available in calendar year 1953 plus an additional 2.25 million milliliters recently added to that amount (by special National Foundation for Infantile Paralysis grant) are to be used in the mass immunization of children living in high-incidence counties. These counties are determined by a formula with reference to:

(i) the United States population under age 15;

(ii) forecasts of national incidence in 1953; and

(iii) the quantity of gamma globulin available for mass prophylaxis purposes.

As of October 5, somewhat more than 1.6 million milliliters have been allocated and used for mass prophylaxis in 22 United States counties plus the area of Juneau, Alaska. Table II presents a summary of gamma globulin mass prophylaxis areas.

3. A contingency fund of 0.6 million milliliters of the gamma globulin estimated to be produced during 1953 was to be reserved for research purposes and special situations. Recently, this fund has been reduced to 0.1 million milliliters and the difference has been made available to the States and Territories for their individual purposes. Approximately 22,000 milliliters have been distributed to 8 investigators for use in field and laboratory problems (table III), and approximately 5,000 milliliters have been made available for use among American citizens living abroad.

TABLE I.—*Poliomyelitis cases reported from May 17 through Sept. 26, 1953, and quantities of gamma globulin available to States and Territories for their own use in poliomyelitis prophylaxis, May 15 through Sept. 30, 1953*

State or territory	Polio cases reported	Gamma globulin available (in milliliters)	State or territory	Polio cases reported	Gamma globulin available (in milliliters)
Alabama	395	36,350	Nebraska	180	33,010
Alaska	32	17,910	Nevada	28	5,190
Arizona	305	41,520	New Hampshire	80	9,430
Arkansas	245	29,190	New Jersey	533	73,850
California	2,061	333,500	New Mexico	72	9,410
Colorado	144	25,560	New York	2,056	250,000
Connecticut	256	32,560	North Carolina	764	80,490
Delaware	25	4,140	North Dakota	138	14,740
District of Columbia	50	7,070	Ohio	1,831	238,630
Florida	366	40,850	Oklahoma	428	49,550
Georgia	312	45,440	Oregon	166	30,360
Hawaii	22	2,090	Pennsylvania	796	102,240
Idaho	37	15,720	Puerto Rico	13	3,060
Illinois	1,550	196,294	Rhode Island	192	23,930
Indiana	494	67,510	South Carolina	126	16,550
Iowa	459	72,770	South Dakota	136	33,680
Kansas	383	50,610	Tennessee	504	59,700
Kentucky	264	36,150	Texas	1,250	140,760
Louisiana	334	36,430	Utah	113	23,760
Maine	239	24,990	Vermont	64	9,640
Maryland	397	69,260	Virginia	592	68,450
Massachusetts	356	45,080	Washington	231	34,800
Michigan	1,623	193,510	West Virginia	373	44,710
Minnesota	1,738	235,070	Wisconsin	480	72,890
Mississippi	273	49,490	Wyoming	44	7,230
Missouri	643	74,530			
Montana	153	18,510	Total	24,316	3,239,134

TABLE II.—*Summary of gamma globulin mass prophylaxis areas (as of Oct. 5, 1953)*

County	Date certified for mass prophylaxis	Quantity of gamma globulin used in milliliter	Age group inoculated and dates	Number inoculated
1. Montgomery, Ala.	June 26	195,750	Under 10 years, June 30–July 3	32,948
2. Caldwell, N. C.	July 2	100,800	Under 10 years, July 6–8	12,600
3. Steuben	July 7	232,860	Under 10 years, July 11–13	37,125
4. Chemung, N. Y.				
5. Catawba, N. C.	July 10	94,500	Under 10 years, July 15–16	14,761
6. Macon, Ill.	July 13	127,720	Under 10 years, July 17–18	[1] 18,000
7. Marquette, Mich.	July 18	60,500	Under 10 years	[1] 8,000
8. Washington, Va.	do	84,500	6 months–9 years, July 22–23	[1] 12,000
9. Sullivan, Tenn. (Bristol City)	do	23,000	do	[1] 3,200
10. Carter, Tenn. (Elizabethton area)	do	55,440	6 months–9 years, July 23–25	[1] 9,200
11. McLean, Ky. (Livermore area)	July 21	17,750	Under 20 years, July 25	[1] 2,300
12. Juneau, Alaska	July 27	18,670	Under 15 years	[1] 2,500
13. Avery, N. C.	Aug. 1	21,000	Under 10 years, Aug. 6–7	3,000
14. Smyth, Va.	Aug. 20	41,000	Under 10 years, Aug. 26–27	6,546
15. Park, Mont.	Aug. 21	28,650	Under 15 years	[1] 3,400
16. Custer, Mont.	Aug. 29	26,800	do	[1] 3,200
17. Stearns	Sept. 4	222,360	Under 15 years, Sept. 9–15	26,721
18. Benton, Minn.				
19. Woodford, Ill.	Sept. 9	37,790	Under 15 years	4,699
20. Polk, Wis.	Sept. 11	61,770	do	[1] 7,200
21. Meeker, Minn.	do	48,570	Under 15 years, Sept. 16–18	[1] 5,700
22. Randolph, Mo.	Sept. 15	50,000	Under 15 years	[1] 5,800
23. Monroe, Fla.	Sept. 28	[1] 58,000	do	[1] 6,800
Total		1,607,430		[1] 226,000

[1] Approximately.

TABLE III.—*Allocations of gamma globulin for research purposes*

Organization or institution receiving gamma globulin	Principal investigators	Quantity of gamma globulin allocated	Date allocation authorized	Nature of research work
		Milliliters		
1. The Presbyterian Hospital.	Dr. Conrad M. Riley	180	May 4, 1953	Clinical, laboratory investigations.
2. Columbia University	Dr. Seymour P. Halbert	12	do	Do.
3. Mount Sinai Hospital	Dr. I. Davidsohn	20	do	Do.
4. Illinois Department of Public Health.	Dr. Leonard Schuman	1,000	June 25, 1953	Special field studies in human populations.
5. Michigan State Department of Health.	Dr. F. S. Leeder	5,000	July 3, 1953	Do.
	Dr. Thomas Francis, Jr.	5,000	July 31, 1953	
6. Florida Southern College.	Dr. Boris Sokoloff	30	July 10, 1953	Animal investigations with Russian encephalitis virus and cancer cells.
7. University of Pittsburgh.	Dr. William McDowell Hammon.	10,500	July 14, 1953	Special field studies in human populations.
8. Abbott Laboratories	Dr. Donalee L. Tabern	60	Aug. 17, 1953	Tagging of gamma globulin with radio-active tracers.

Mr. DOLLIVER. Any other questions? Thank you.

Dr. Andrews?

Dr. ANDREWS. We want now to bring before you the testimony on the experience of someone who has had the responsibility of making distribution of this product within the States. Dr. Roy Norton is the State health officer of the State of North Carolina, a State which has been beset this summer with poliomyelitis, and so he has had the opportunity of learning a good bit about its intrastate distribution. Dr. Norton.

Mr. CARLYLE. Mr. Chairman, I should like to make a statement.

Mr. DOLLIVER. Yes.

Mr. CARLYLE. Dr. Norton has been my friend for a long number of years. I know him. He is now secretary and treasurer and State health officer of the State Board of Health of the State of North Carolina. He is an eminent doctor and one of the outstanding authorities on the subject of public health in this country. We are fortunate that he can be with us at this time.

Mr. DOLLIVER. Your statement lifts Dr. Norton even more in our estimation.

Mr. CARLYLE. I know Dr. Norton.

STATEMENT OF DR. ROY NORTON, STATE HEALTH DEPARTMENT, RALEIGH, N. C.

Dr. NORTON. Chairman Dolliver and members of the committee, I appreciate the kind words of my good friend Representative Carlyle.

You have heard from a good many here who have done a lot of scientific research on the problem of polio and gamma globulin. You have heard from General Grant with regard to the problems of the collection of the raw materials and processing it and getting it ready. You have heard from others who have tried to work out an equitable and efficient method of distribution, so that with what we have we can do at least two things. One is to learn more about it, because there are still many things we want to know. Also, wherever it can be used effectively, we want to see that it can be put to the best use, for it is a very limited and precious material.

I am here because in North Carolina we have had three counties in which we have actually given the gamma globulin on a mass basis. And I have made available to you, if you like, three pieces of literature. One is on the organization and operation of mass inoculation clinics for the administration of gamma globulin, where we had to work in a rather uncharted area. Montgomery, Ala., had had some experience, but it was so recent that we were not able to get exactly what they did before we were confronted with the problem ourselves. Therefore, in Caldwell County we had to move along and try to do the best we could. We have here a preliminary report of Caldwell County, and also a preliminary report of Catawba County. We do not yet have a report on Avery County.

Altogether we gave gamma globulin to about 30,000 children under 10.

The two preliminary reports give some indication of what happened afterward. In other words, the cases that did occur, and whether they were paralytic, or nonparalytic, and so forth. I think you would be particularly interested in the one that gives the organization and operation in the development of these clinics.

We feel that perhaps our experience there may be of use in the States. This has been submitted to the public-health reports so that it can be given wide distribution and copies will be sent to the State health officers in other States for their use because the chances are we will be doing some of this same thing next year. It will help them not to have the problem that we did of trying to work out all the problems of getting physicians, of getting registered nurses, of getting public-health nurses, of getting practical nurses, and of getting voluntary workers who could do the clerical work.

You will find in there a chart which will show the record for the children—how they came in, how transportation was provided, how supplies were received, how they were refrigerated, how they turned out to the different spots in the county which were selected, how the publicity was given, how all the radio and various other media such as the newspapers, and so forth, cooperated, and so forth. All of the children when they came in were given tags with numbers on them, and the amount of gamma globulin they would get was calculated, and everything about them is recorded as they moved right on through to where they ended up with a popsicle and some ice cream to fill their mouths to keep them from being excited too much at the end of the time and disturbing the others. We hope that will be important.

I will stop here because I do not have a prepared report, but we have had some practical experience with gamma-globulin distribution; we have encountered some of the problems that have been raised in questions here and we are particularly hopeful that, whereas this gamma globulin is what we refer to as a passive, short-term type of protection or immunization, we may look forward to the time when we will have something that will give an active, long-time immunization, and, of course, work is underway toward that end. That is the thing we are hoping for.

It has been brought out that it would be practically impossible to get enough blood to use as much as we might like to use, or as much as the demand might require that we use, and we are looking forward to the time that we will get this vaccine such as we have against smallpox, typhoid, and diphtheria, and other diseases. Thank you very much.

Mr. DOLLIVER. Doctor, in glancing over this material which you furnished us, it occurs to me that it should be in the record of our proceedings; subject to the veto of our regular chairman, it will be so included.

Dr. NORTON. Thank you, sir.

(The matter referred to is as follows:)

PRELIMINARY EPIDEMIOLOGICAL REPORT OF POLIOMYELITIS OUTBREAK, CATAWBA COUNTY, N. C., 1953

INTRODUCTION

While in Caldwell County, N. C., during the period from June 29 to July 8, rendering epidemiologic assistance to Dr. William Happer, county health officer, during an outbreak of poliomyelitis, I received a call from Dr. Benton V. D. Scott, health officer in neighboring Catawba County, relative to poliomyelitis in that county. Dr. Scott stated that up to July 8, 27 cases of poliomyelitis had been reported in Catawba County, with all cases except one occurring since June 1. He stated that a communitywide quarantine had been invoked and that the medical profession was considering asking that gamma globulin be given on a communitywide basis. He asked that as soon as it was possible to leave Caldwell County, that epidemiological assistance be given in Catawba County.

(1) Description of the area

Catawba County is located in western North Carolina along the route of Highway 70, one of the main east-west arteries in the State. The 1950 census showed a total population of 61,794, 5,598 of whom are Negro. Two-thirds of the county is classed as rural with approximately 21,000 persons residing in communities of over 2,500 persons. The two leading communities are Hickory and Newton, the former noted as a furniture manufacturing and textile center.

(2) Past history of poliomyelitis in Catawba County

Catawba County has been the site of at least 2 major poliomyelitis outbreaks prior to 1953. In 1944, 71 cases were reported for a rate of 126.9 cases per 100,000 population. In 1948, 97 cases were recorded for a rate of 161.3 cases per 100,000 population. In 1950 the rate was 9.7 per 100,000; in 1951, 28.6 per 100,000; and in 1952, 12.5 per 100,000. The rate to date with 96 cases reported is 147 per 100,000 based on a 1953 population estimated at 65,088. It is adjacent to Caldwell County which experienced a rate of 299 per 100,000 this year.

(3) Community health resources

Some 40 physicians are in active practice in Catawba County, which is served by 2 hospitals in the Hickory community and 1 hospital in the Newton area. Facilities for isolation and prolonged care of contagious disease patients are limited and the bulk of poliomyelitis patients are referred to outside poliomyelitis care centers. The Catawba County Medical Society is an active group, representative of the physicians in the county.

The health department serving Catawba County is affiliated with two other counties in the Catawba-Lincoln-Alexander District Health Department. The district health officer, Dr. Scott, resides in Hickory and the headquarters for the district health department is in Newton. The department is well-staffed with qualified personnel and is offering a well-balanced program of public health activity.

(4) Procedure for the reporting and handling of poliomyelitis patients

No general outpatient facilities are available in the community hospitals of Catawba County and all patients were seen by private physicians in the home or office. The majority of patients diagnosed as having poliomyelitis had lumbar puncture. Reporting of poliomyelitis cases to the health department was by telephone, at which time identifying data, clinical symptoms, laboratory results, and the number of contacts requiring gamma globulin was given. The actual administration of globulin was carried out by the family physician in his office. The majority of Catawba County patients were referred to outside poliomyelitis care centers—Greensboro, Charlotte, Asheville, or Winston-Salem. The referral was handled by the chairman of the local Poliomyelitis Foundation chapter who is a physician.

(5) Community prophylaxis with gamma globulin

At a meeting on July 8, 1953, the membership of the Catawba County Medical Society went on record as requesting that gamma globulin be given on a communitywide basis to all children 9 years of age and under. This request was forwarded to the State health officer immediately and on July 15, 16, and 17 a mass inoculation program was carried out during which 14,761 children were inoculated with gamma globulin. The organization of the program was very similar to that of Caldwell County, with few exceptions. The planning, organization, and staging of such a program is the subject of a separate report which is now in preparation.

EPIDEMIOLOGICAL INVESTIGATION

This investigation was initiated by the Chief of the Communicable Disease Control Section during the stay in the county, July 8 through July 16. These initial investigations have been supplemented by reports from the local health officer and his staff, from the morbidity unit of the Communicable Disease Control Section, and by the results of a field investigation performed by an evaluation team from the United States Public Health Service. Preliminary data is as presented in the following, and information as to the multiple case households will be released by the Communicable Disease Center of the United States Public Health Service in Atlanta, Ga. Additional data as to the environmental sanitation in and around the homes of the poliomyelitis patients will be released at a later date by the State board of health.

(1) Onset of cases by time interval

The first case in 1953 in Catawba County was reported in February 1953. The county was without further reported cases until the first week in June when one additional case was reported. A total of 27 cases had been reported by July 8 and the rate at that time was 41.5 cases per 100,000 population. The peak number of cases had their onset during the week of July 5 when 30

were shown to have developed clinical symptoms. Again it appears that gamma globulin was not given until the outbreak had passed its peak. Nineteen cases had onsets during the week the mass inoculation program was carried out, and in the week following 18 cases were stricken. By the week of July 26, only five additional persons became ill. The onset of cases by week is given in table 2 and is shown in graph 1.

(2) *Distribution of cases by age*

Table 3 shows the age distribution of cases and it is evident that the age group 1–4 not only experienced the greatest number of cases but had the highest age specific attack rate. Only 3 children under 1 year of age were infected while over 20 percent of the total cases were over 14 years of age. Compared with Caldwell County this group experienced a slightly higher age specific attack rate. It is to be noted that Caldwell County experienced a much higher age specific attack rate in the age group 1 to 4 years. The age specific attack rates are given in table 3.

SEX DISTRIBUTION OF CASES

A total of 58 males and 38 females was recorded in the total number of cases. The sex specific attack rate for males was 1.90 per 1,000 and 1.21 per 1,000 for females. This and additional data as to the sex specific attack rate in whites and Negroes is given in table 4.

RACIAL DISTRIBUTION OF CASES

Ninety-five of the total cases were among white families and one case was reported from a Negro family. (See table 4.)

TYPE OF DISEASE

Table 5 shows the provisional diagnosis, by age groups, for the Catawba County outbreak. Of the 96 reported cases, 68 have been classed as paralytic for a percentage of 71; 26 cases, or 27 percent, have been reported as nonparalytic, and 2 cases, or 2 percent of the total, have been shown as unspecified pending further study. These percentages correspond almost exactly with the distribution of disease by type for Caldwell County. Four deaths have been recorded for a case fatality rate of 4.15 percent. Three of the deaths were in persons 12 years of age or older. The single exception was that of a 5-year-old white male.

POSSIBLE INFLUENCE OF GAMMA GLOBULIN

As in Caldwell County, the mass inoculation program with gamma globulin was not carrired out until after the epidemic had passed its peak. This is despite the fact that the preparation for the program was started as quickly as the county could qualify under the Office of Defense Mobilization regulations pertaining to the distribution of globulin. It seems very likely that the number of cases was declining prior to the time that the administration of globulin could have been expected to manifest any marked influence on the course of the epidemic. It is noted that the number of cases occurring in the age group over 9 years, the majority of whom did not receive globulin, showed a relative increase in the period following the mass inoculation program. This raises a very strong possibility that the gamma globulin could have served as the coup de grace for a rapidly dying epidemic. In view of the time relations, and in view of the duration of poliomyelitis outbreaks in previous years in Catawba County, it appears that the actual duration of the epidemic was not materially shortened, and that the number of susceptibles in the county was dropping rapidly before the time the globulin would have had any influence.

Information as to the 15 cases which developed poliomyelitis after receiving gamma globulin is summarized in table 6. The longest interval noted between inoculation and onset of symptoms was 11 days. More than 70 percent of the developing cases showed clinical symptoms within 5 days after receiving gamma globulin. Eighty-seven percent of the group who became ill with poliomyelitis after receiving gamma globulin developed paralytic disease, the extent of which can be evaluated only after detailed individual muscle tests are completed. There were no deaths among the group who received globulin.

SUMMARY AND CONCLUSIONS

Preliminary epidemiological data have been presented for the poliomyelitis outbreak in Catawba County, N. C., which experienced its second most severe outbreak of poliomyelitis in its history in the summer of 1953. A total of 96 cases have been recorded to date this year for a rate of 147.5 per 100,000 persons.

Catawba County was the second North Carolina county to stage a mass inoculation program with gamma globulin during 1953. The program followed the one in neighboring Caldwell County by about 1 week. It again appears that the community inoculation program was not started until after the epidemic had reached peak and until the number of cases was declining sharply. In view of the size of the county, the population density, and the time relationships, it seems questionable that the gamma globulin program could have had any marked influence on the course of the epidemic.

It is noted that before and during the period following the administration of globulin the number of cases continued to drop with some slight relative increase in the number of cases in the uninoculated group. A total of 15 individuals developed poliomyelitis after receiving gamma globulin, 13 of whom have been classed as having paralytic disease.

In light of the questionable influence of this blood product and magnitude of the undertaking a mass inoculation program, plus the possible outcome of offering only short-term immunity to large numbers of individuals, it seems imperative that more detailed studies on the use of gamma globulin as a poliomyelitis control measure be undertaken. It is to be hoped that additional information will be available before public health officials are confronted again with the decision of whether or not to utilize gamma globulin on a community basis.

Additional studies relating to the Catawba County epidemic are now in process and will be released at such time as they are completed. This will include data on environmental sanitation, possible contact of patients with known cases, and similar material.

Report by Dr. Charles M. Cameron, Jr.

TABLE 1.—*Resident poliomyelitis, Catawba County, N. C.*

[Reported cases by year of onset, number of cases, and rate per 100,000]

Year	Number of cases [1]	Rate per 100,000 [2]	Year	Number of cases [1]	Rate per 100,000 [2]
1940	0	0	1947	6	10.0
1941	4	7.6	1948	97	161.3
1942	4	7.4	1949	13	21.3
1943	1	1.8	1950	6	9.7
1944	71	126.9	1951	18	28.6
1945	1	1.8	1952	8	12.5
1946	14	24.2	1953	96	147.5

[1] Number of cases from annual morbidity report of the North Carolina State Board of Health.
[2] Population base for rates corrected yearly by arithmetic method.

TABLE 2.—*Resident poliomyelitis, Catawba County, N. C., 1953*

[Reported cases by week of onset] [1]

Week	Number of cases	Percent of total	Week	Number of cases	Percent of total
1953—June 7	1	1.0	1953—July 12	16	16.8
June 14	7	7.3	July 19	18	18.6
June 21	4	4.2	July 26	5	5.2
June 28	15	15.6	Aug. 2	0	0
July 5	30	31.3			

[1] Does not include 1 case with February 1953 onsets.

Poliomyelitis - Catawba County, North Carolina 1953
Onset of Cases by Week
G.G.
Number of Cases
30
25
20
15
10
5
June 7-13
14-20
21-27
28-4
July 5-11
12-18
19-25
26-1
August 2-8
Week of Year

TABLE 3.—*Resident poliomyelitis, Catawba County, N. C., 1953*

[Age distribution of reported cases by number, percentage of total, and age specific attack rate per 1,000 population]

Age group	Number of cases	Percentage of total	Rate	Age group	Number of cases	Percentage of total	Rate
Under 1	3	3.1	2.15	15 to 19 years	9	9.4	.483
1 to 4 years	35	36.5	7.10	20 to 24 years	5	5.2	
5 to 9 years	24	25.0	3.74	25 and over	7	7.3	
10 to 14 years	13	13.5	2.33	All ages	96	100.0	1.55

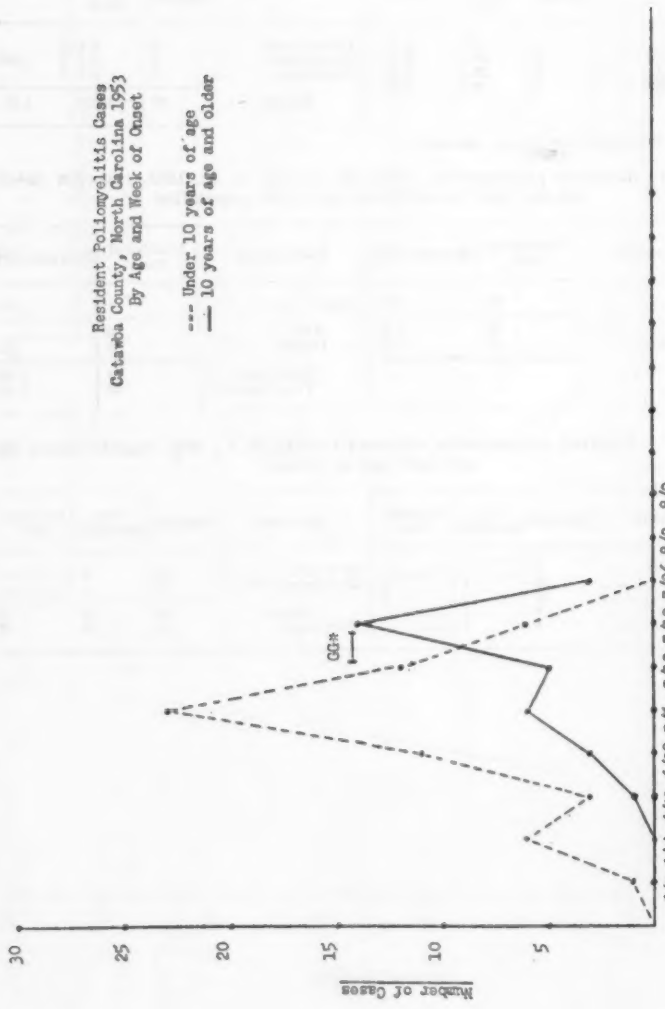
NOTE.—Population base for rates, 1950 census.

TABLE 4.—*Resident poliomyelitis, Catawba County, N. C., 1953, reported cases by race and sex with rate per 1,000 population*

Race and sex	Number of cases	Rate per 1,000	Race and sex	Number of cases	Rate per 1,000
White	95	1.69	Negro	1	.18
Male	58	1.89	Male	0	
Female	37	1.18	Female	1	.35
			Total male	58	1.90
			Total female	38	1.21

TABLE 5.—*Resident poliomyelitis, Catawba County, N. C., 1953 reported cases by age and type of disease*

Age group	Paralytic	Non-paralytic	Unspecified	Age group	Paralytic	Non-paralytic	Unspecified
Under 1 year	3			20–24 years	2	3	
1–4 years	30	4	1	25 years and over	5	2	
5–9 years	14	9	1				
10–14 years	6	7		Totals	68	26	2
15–19 years	8	1		Percentage	71	27	2



* Gamma Globulin Mass Inoculation July 15-16-17

TABLE 6.—*Resident poliomyelitis, Catawba County, N. C., 1953 reported cases with onset subsequent to receiving gamma globulin, by type of disease and interval between inoculation and onset of symptoms*

Type of disease	Interval in days between inoculation and symptoms and number of cases								
	0	1	2	3	4	5	6	7	Greater than 7
Paralytic	3	2	1	1	2	0	2	0	(1) (2)
Nonparalytic	0	0	0	1	0	1	0	0	0
Totals	3	2	1	2	2	1	2	0	2

	Interval		Total
	0–5 days	5 days and over	
Paralytic	9	4	13
Nonparalytic	2	0	2
Totals	11	4	15

[1] 9 days.
[2] 11 days.

ORGANIZATION AND OPERATION OF MASS INOCULATION CLINICS FOR THE ADMINISTRATION OF GAMMA GLOBULIN

By Charles M. Cameron, Jr., M. D.,[1] chief, communicable disease control section, North Carolina State Board of Health, division of epidemiology; Fred T. Foard, M. D., director

FOREWORD

The contents of this discussion are based on experience gained during the summer of 1953 in assisting with the organization and staging of three separate mass-inoculation programs in three western North Carolina counties.

When initially confronted with the task of designing, organizing, and staging an operation of this type, one experienced a very keen desire for a guide or manual to assist the public-health administrator in appraising the magnitude of the undertaking. This presentation is designed to partially meet this need.

It is to be hoped that the development of an effective antipoliomyelitis vaccine will remove the necessity for continuing to use gamma globulin as a poliomyelitis-control measure. At the present time, it does not appear that such a vaccine will be available for all children at any time in the near future. It would seem safe to predict that North Carolina public-health workers again may be faced wtih the task of inoculating, on a mass basis, large numbers of children. Perhaps the experience gained in the summer of 1953 will be of some value to them.

Civilian-defense officials have suggested that an effective method of attack against the civilian populace of the United States in time of war would include biological, or so-called germ warfare. In such an event the health departments of the Nation would be faced with the inoculation of large numbers of persons in a short time. Perhaps the experience in administering gamma globulin would be of assistance to them in event of this untoward circumstance.

Grateful acknowledgment is made to Dr. William Happer, health officer of Caldwell County, N. C., and Miss Frances Williamson, health educator with the Caldwell County Health Department, who collaborated with the author in the actual formulation of the first master plan. Without their interested cooperation and endeavor, such a program could not have been accomplished.

[1] Dr. Cameron, as chief of the communicable disease control section, division of epidemiology, was in immediate charge of the organization of mass gamma globulin clinics in Caldwell, Catawba, and Avery Counties, where poliomyelitis was prevalent in epidemic form during the months of July and August 1953.

Recognition should be given to the thousands of citizens of the State of North Carolina—physicians, nurses, parents, merchants, teachers—representing every group in the State, who volunteered their time and effort to make the mass globulin programs a success.

RALEIGH, N. C., *August 1953.*

An outbreak of poliomyelitis has always been a difficult period for the public-health authorities of any community; however, during the past 2 years the evolution of immune human globulin as a possible poliomyelitis control measure has greatly increased the responsibilities and fortitude required of the health officer and his staff when faced with a mounting incidence of poliomyelitis.

Gamma globulin has had the dubious distinction of receiving the widest publicity in the lay press of any recent development in the field of medical science. Gamma globulin has become a household word. Its use in poliomyelitis almost overnight has become a topic of discussion at the breakfast table, at the luncheon club, and over the bridge table. The health departments at both local and State level have been swamped with telephone calls and requests from anxious parents seeking globulin inoculations for their children.

Unfortunately, many optimistic and extravagant claims have been made as to the effectiveness of the protection afforded by this blood product. A tremendous amount of misinformation abounds in both the lay public and the medical profession as to the place of globulin as a poliomyelitis control measure. It has been most encouraging that Dr. Hammon, whose group at the University of Pittsburgh developed the scheme for the use of gamma globulin in poliomyelitis, has taken a very guarded approach as to the value of this product both in family contacts and in mass community prophylaxis, but it has been the experience in several North Carolina communities hard hit by poliomyelitis this summer that the limitations of globulin have been largely overlooked in the near hysteria which has developed and there has been a growing demand, from the public and the medical profession, that all children be inoculated with globulin.

It seems apparent that until such time as a safe, easily administered, effective vaccine is developed as a preventive measure against poliomyelitis, gamma globulin again and again will be used in both a limited and wide-scale endeavor to control this disease. At the present time gamma globulin is in short supply due chiefly, it is said, to a shortage of facilities for fractionating it from human blood; however, additional fractionating laboratories are now under construction and should be in operation within the year. Officials of the National Foundation for Infantile Paralysis have stated privately that a large-scale field trial with a killed virus vaccine may be carried out in the fall of 1953, but it must be assembled that general limitations of this type of vaccine will hold and an effective poliomyelitis vaccine may still be several years away. Gamma globulin seems destined to remain in the poliomyelitis scene for some time to come.

North Carolina has had some 30,000 children inoculated on a mass basis in 3 separate western North Carolina counties during the period from July 6 to August 7, 1953.

Inoculations were given in Caldwell County on June 6, 7, and 8 where 12,800 children were processed in the 3 days. Catawba County was the site of a 3-day inoculation program on July 15, 16, and 17 at which time 14,761 children were given gamma globulin. In Avery County during a 2-day program on August 6–7, 3,092 children were inoculated.

In terms of the number of mass inoculation programs, North Carolina has had the most experience with globulin used on a mass basis of any State in the Nation. Unfortunately the organization experience gained by the medical and other groups during the initial field trials with globulin in 1951 and 1952 was not available to the public-health workers when these first programs were being planned in North Carolina. The Foundation for Infantile Paralysis representatives who arrived in Caldwell County in some number were not acquainted with the details of setting up a globulin mass inoculation program and the planning and administering of the program fell entirely to the local health officer and his staff and the State board of health consultants.

On this basis, a pattern was developed which has been used successfully on three different occasions and may be said to be highly effective in meeting the requirements for such an activity in this State. It has been interesting to note from the reports from the States where mass inoculation has been performed that each State has been faced with the task of developing a pattern to meet its own needs and while this is an absolute necessity in carrying out any program, in terms of the magnitude of the undertaking it seems desirable that

at least some of the experience gained from the mass inoculation clinics be made available to assist the health departments of the State or of other States in performing the myriad of tasks confronting the public-health agencies in setting up any emergency program of this type in a community.

The purpose of this discussion is to outline the purely administrative aspects of formulating and carrying out a globulin mass inoculation clinic. The criteria which must be fulfilled by a county prior to receiving globulin from the Office of Defense Mobilization vary from time to time based on the amount of globulin available, and accordingly, will not be included. The circumstances of the epidemic which determine the effectiveness of gamma globulin are presented in the appendix as an attachment.

GLOBULIN CLINIC TIMETABLE

The timetable of events in the North Carolina programs has roughly assumed this sequence:

1. The county medical society has unanimously asked the local health department to forward to the State health officer a request that the county be considered for the mass use of gamma globulin. On the basis of the age distribution of the cases reported to date, the society has also set the age limits of the group to receive globulin. Usually this has been all those children between birth and 10 years of age.

2. The local health officer has forwarded the request, along with an estimate of the number of children in the selected age group which is obtained from census reports, birth rates, and death rates. To determine a county's eligibility, it is necessary for the health officer to supply the following additional data to the State health officer:

(1) Total number of cases with age distribution.
(2) Onset of cases by day.
(3) Number of deaths from poliomyelitis.
(4) Ratio of paralytic cases to nonparalytic.
(5) Number of respirator cases.

3. The request is reviewed by the State health officer and, if approved, is forwarded by telephone to the Office of Defense Mobilization in Washington which advises that globulin will or will not be granted and the total amount which will be made available, as well as when it will reach the county.

4. The county is advised immediately by the State board of health of the amount of globulin which will be made available and the date when it will reach the county. The State health department, either from the central office or directly from the field, contacts the New York office of the National Foundation for Infantile Paralysis informing them that gamma globulin has been granted to the county and the estimated number of children to be inoculated. Sufficient supplies of needles and syringes are requested for this group.

5. The globulin is shipped directly by air from the manufacturer to the county health officer. The average dose is now estimated at 7 cubic centimeters per child and the amount granted is computed on this basis. Globulin must be stored and maintained at 40° to 50° F., and appropriate storage facilities in the county must be obtained.

6. The National Foundation for Infantile Paralysis ships by air express directly to the county the following materials:

(1) Disposable 20- or 22-gage 1½-inch needles—1 for each child (nonsterile).
(2) 5 and 10 cubic centimeter Luer lock syringes in a ratio of about 1 syringe for each 2 children to be inoculated (nonsterile).
(3) Syringe cleaner—powder.
(4) Wraps or envelopes for packing syringes and needles for autoclaving.
(5) Rubber bands.
(6) Syringe opener for stuck syringes.
(7) Rolls of paper for clinic tables (was not supplied at last of three inoculation programs).

The needles and syringes must be packaged and autoclaved prior to use in the clinics.

7. The local health officer is then responsible for determining the number and schedule of clinics necessary to cover the county. In arriving at this, it is necessary to take into consideration:

(1) Physical facilities such as schools or other suitable clinic sites.
(2) Population distribution within the county, routes of transportation and communication, and the general availability of a means of transportation.

(3) Number of local physicians, nurses, and nurses' aids available to staff the clinics.

School lunchrooms have been the clinic sites best suited for this operation in North Carolina. School authorities have been most cooperative in making all facilities available. Schools are located usually in centers of populations and easily reached by road, and parents have been asked to go to the clinic nearest their home. It has not been considered feasible to attempt to assign the residents within certain geographical areas to any particular clinic, neither has it seemed necessary to attempt to take various segments of the population on an alphabetical basis due chiefly to the limited amounts of globulin which has usually been exhausted prior to the conclusion of scheduled operations.

The North Carolina clinics have been scheduled to operate for either 10 or 12 hours per day. Caldwell and Catawba County clinics were inoculating from 9 a. m. to 9 p. m., which required 3 shifts of workers per day. Avery County clinics were open from 10 a. m. to 8 p. m., and 2 shifts per day were employed.

8. At this point several necessary efforts are carried out simultaneously. These are:

(1) The State board of health is requested to recruit any additional physicians and nurses which may be needed to staff the clinics.

(2) Organization for local lay workers is set up and recruiting for the volunteers is started.

(3) The items of supply which must be obtained locally are listed and procurement begins. (See attachment II for listing of equipment and supplies.)

(4) Public-relations outlets such as press and radio are alerted and arrangements are made for the regular release of pertinent information, particularly within the county.

9. Once clinic sites have been agreed upon, it is necessary to see that tables and other fixtures are available, and that water, lights, refrigeration, and telephone are in operating condition.

10. Two nights prior to the opening of the clinics a mass meeting of all volunteer workers is held at the clinic at which they will serve. At this time job assignments are made and the technique of clinic operation is outlined.

11. On the day prior to the inauguration of the clinic operation, supplies are moved to the clinics from the central supply depot with the exception of the gamma globulin, which is retained in refrigeration until the day the operation begins.

12. Local professional personnel are assigned to the respective clinic as they are recruited. As the outside professional personnel arrive they are assigned living quarters by the health department staff member in charge of housing of professional workers. They are assigned also to work in the respective clinics as they arrive and arrangements for transportation to the clinic sites are completed with the motor pool.

13. On the morning of each clinic operation, the supply of gamma globulin is dispatched to the clinics from the storage point. The amount of golbulin distributed to each clinic each day depends upon the size of the clinic, the population in the immediately surrounding area and the weather conditions. A single-unit clinic, based in an area with easy access to the populace, and operating in clear, dry weather, can easily inoculate between 800 and 1,000 children in 10 to 12 hours of operation. Any globulin remaining at the close of the clinic hours each night is returned to the central storage depot where it is inventoried for redistribution the following morning.

CLINIC ORGANIZATION

A basic clinic unit has set up for all North Carolina clinics. Each unit is comprised of the professional group and the lay group. Each lay group is so designed that it is possible to process patients for one or more groups of professional workers. In smaller operations the clinic was comprised of one professional group and one lay group, but in the larger operations in Catawba County each lay group served 2 or 3 professional groups with ease.

PROFESSIONAL PERSONNEL

It has been customary in the North Carolina operations that all inoculations be given by physicians. This has been done to avoid any criticism which might have arisen as a result of any immediate or delayed untoward reaction to the injections. The basic professional operational unit has contained 2 physicians,

5 registered nurses, 1 public-health nurse, and 4 nurses' aids. In some instances nurses have performed the aides' duties, but have rotated jobs with the other nurses in the setup. The duties of 4 of the registered nurses are to check the dose of globulin which has been calculated at the weighing table and to fill the syringe with the correct amount of globulin. In addition one nurse has been assigned to circulate in each clinic for relief and to supervise cleaning and packing of syringes as well as distribution of other supplies. The aides' duties have consisted of transporting the filled syringe to the injection table without contamination and assisting the physician by cleaning the skin. A local public-health nurse has been assigned to each clinic and has been designated as the professional worker in charge of the entire operation. It is this nurse's responsibility to see that each worker is carrying out his prescribed tasks, that sufficient supplies are on hand and that the clinic operates at maximum efficiency at all times. Local physicians have worked 4-hour shifts since they have responsibilities in the community in caring for sick individuals while physicians recruited from outside sources, who have no other immediate responsibilities, have worked 8-hour shifts. The majority of nurses and nurses' aids in the local community have been used on 4-hour shifts while nurses recruited from other county health departments, other agencies, etc., have usually worked at least 8 hours per day. It has been necessary for the public-health nurse in charge to remain on duty throughout the hours of operation, either 10 or 12 hours, with only short periods of relief.

It has been customary to enlist the assistance of all professional workers—physicians, nurses, nurses' aids—who are residents of the county. In no instance has the number present in the county been sufficient to meet the staffing requirements of the program.

In the recruiting of additional personnel, the North Carolina State Board of Health has played a key role in the staging of the globulin clinics. Working through the division of epidemiology, the State board of health has contacted scores of county health departments in the State seeking volunteer public health nurses who could be spared from their usual duties in the counties to participate in the 3-day mass inoculation program. The response from the local health officers of the State in making personnel available was excellent, and indicative of the good-neighbor policy which exists between health departments in North Carolina.

The board's division of epidemiology also took the lead in contacting the 3 medical schools in the State in requesting that resident physicians be made available to assist in the giving of gamma globulin in the 3 counties. Duke University School of Medicine and Memorial Hospital at Chapel Hill, and the Bowman Gray Medical College and Baptist Hospital in Winston-Salem made physicians available to serve in the clinics. The globulin programs would not have been possible without their assistance.

In all North Carolina operations, professional workers have volunteered their time; however, they have been reimbursed for the cost of transportation, rooms, meals, and other expenses incidental to their being in the county. This expense has been paid by the National Foundation for Infantile Paralysis.

LAY WORKERS

All lay workers needed to operate globulin clinics have been recruited in the community in which the operation is being staged. The health officer has named in each county an overall chairman for volunteer lay workers who has in turn named a chairman for each of the proposed clinics, who has had the responsibility for recruiting and assigning volunteer workers to the various shifts at the clinic.

In many instances these chairmen have recruited the entire membership of various community clubs and organizations to serve a given shift in the clinics. In the case of a clinic scheduled to operate in the same site for more than 1 day, the same group is asked to work the same shift each day to reduce the time lost and confusion in the reorientation of lay workers.

Persons under 16 years of age, pregnant women, and those persons suffering from acute or chronic communicable diseases have been excluded from the volunteer ranks.

A minimum of 40 lay workers is needed per shift for each basic clinic unit; however, the single basic lay unit has been able to handle the patient load for as many as 6 or 8 physicians and the corresponding number of nurses and aides. This has been accomplished by adding one guide for each injection table added to the clinic.

All lay workers have served without reimbursement and have worked directly under the supervision of the lay chairman for each clinic. The usual shift of duty for the lay volunteers has been from 5 to 6 hours per day since this group must assist prior to the opening of the clinic in distribution of supplies and materials as well as remaining for clearing up after the clinic has closed.

(See appendix for a listing of the required workers for each clinic.)

POLIOMYELITIS TRANSPORTATION CORPS

An integral part of the lay organization is the transportation corps which has the following responsibilities:

(1) Transportation of any parents and children to and from the clinics where these persons do not have means of reaching the clinic.

(2) Transportation of professional personnel to and from the clinics, particularly in those cases where workers are recruited from areas outside the county who may not have transportation, or may not be familiar with the county.

(3) Transportation of lay volunteer workers to and from clinics if they have no means of reaching the clinic where they will work.

Organization and operation of the transport corps has been successfully delegated to a local club or organization which has called on automobile dealers, taxi companies, and other groups to assist in supplying automobiles and drivers. Headquarters for this motor pool has been set up at some point other than the health center to reduce traffic and telephone calls into the center which usually serves as a nerve center for the entire operation. The telephone number of the motor pool headquarters has been widely circulated in the county area and in the three North Carolina programs it served a very valuable need.

A separate unit of the motor pool has been the trucks, jeeps, and other vehicles which are needed to transport supplies and other materials to and from clinic sites. This unit has usually functioned directly under the health department staff.

CLINIC OPERATIONS

(See attached flow diagram.)

The parent and child are met at the entrance to the building by a hostess who assigns each child a number in order of the arrival at the clinic. This number is written on a small tag and pinned to the child's back in such manner as to be visible when the child is on the injection table. If the group waiting is large, the parent is advised to wait either outside the building or in the auditorium. A public address system is used to call the children back to the clinic in groups of 20 if such a waiting procedure is necessary. If the number waiting in line is small, the parent and child are sent directly to the clinic. A guide meets each child and accompanies the child and parent through the whole clinic operation.

The first stop for parent, child, and guide in going through the clinic is at the registration desk where a 3 by 5 index card is filled out with the child's name, age, sex, and race and with the parent's name and address. The number on the child's tag is recorded on the card.

The second stop is at the weighing table where the child is weighed and the globulin dose calculated, using a weight-dose chart. The dose is entered on the registration card (see appendix for sample dose chart).

This card is dropped off at the nurses' table and the child taken to the injection table, placed on the table and disrobed as much as necessary.

The nurse checks the calculated dose using a weight-dose chart, fills a syringe with the correct dose and hands both the syringe and card to the aid who takes them to the table where the child has been placed. It was determined that by assigning each physician four injection tables there was almost no physician-time lost while getting children off and on the tables. The syringe is handed to the physician by the aid who then returns to the nurses' table. After the physician has innoculated the child, he hands the syringe to the guide who gives it to the worker at the first wash table. The guide then assists the mother in dressing the child and escorts them to the exit where the child receives candy and ice cream and the mother is given a leaflet explaining gamma globulin. The guide then returns to the entrance to meet another parent and child.

At the first syringe wash table, the syringe and needle are flushed with washing solution, the needle removed, the two parts of the syringe dismantled and fastened together with rubber bands. The syringes are then allowed to soak for 20 minutes in the cleaning solution at which time they are taken to the second wash table, where they are cleaned with a bottle brush, rinsed, and placed on

a clean sheet to dry. Drying is facilitated by the use of electric fans blowing over the area. Following drying, the syringe, without reassembling, is either wrapped in a Steri-Wrap or a paper towel or dropped into a small envelope. They are then packed into wire baskets and returned to the hospital for autoclaving.

ADMINISTRATION OF MASS INOCULATION CLINICS

(See chart of administrative organization.)

The local health officer of the respective counties has been the official in charge of the entire operation within the county. He works directly under the supervision of the local board of health and has been assisted by a poliomyelitis committee of the local medical society and by the chief of the communicable disease control section of the State board of health's division of epidemiology. The decisions as to the sites, scheduling, and operation have been left to the local health officer to work out with the aid of his staff and consultants.

The recruitment and scheduling of local professional personnel in 2 instances was handled directly by the health officer or a health department staff member and in 1 case was the responsibility of a member of the poliomyelitis committee of the local medical society. Both systems worked equally well. The recruitment of extra professional workers from outside the county was handled in every instance by the State board of health and housing and scheduling of these workers was handled by the local health department staff.

The scheduling and handling of lay workers is delegated to the lay chairman and his associates.

PUBLIC INFORMATION

Informing residents of the county regarding the details of the inoculative program schedule was not a problem in those counties with local radio stations and local newspapers which are published daily. In the instance of Avery County, however, which is without these outlets, the problem was more difficult. The following procedures were followed:

(1) All telephone subscribers were called and advised of the clinic sites and schedules.

(2) All persons on the tax rolls were mailed a postcard giving the necessary information.

(3) Posters and leaflets were prepared and distributed over the county.

(4) All rural mail carriers were advised of the facts and asked to spread the word along their routes.

(5) All ministers were asked to contact the members of their churches regarding the clinics.

(6) Two local political organizations representing the Democrats and the Republicans were enlisted and they agreed to spread the word from house to house in the more isolated areas of the county.

(7) All volunteer clinic workers who attended a mass meeting 2 nights prior to starting the clinics were asked to carry the word to their respective communities.

(8) Radio stations and newspapers in outside areas which come into the county were asked to feature the news for Avery County residents.

Relations with the press proved to be an important phase of the operation. In two counties all contact with the press was made by the local health officer and in a third county a lay worker with newspaper background was placed in charge of the press releases. The former method is more effective inasmuch as it is difficult for a layman to interpret and translate medical concepts and ideas as effectively as a physician. In addition it permits the health officer to maintain close supervision over the content of the press releases, which is not possible in the latter method. In view of the varied organizations involved in such programs, close supervision of press releases is vital since there may be a tendency to distort the importance of the roles of the respective organizations.

Releases to the press and radio have featured the following material:

(1) Clinics will remain in operation at all times during the scheduled hours and will continue until all the specified children have been inoculated or until the supply of globulin is exhausted.

(2) Only children who are regular residents of the county or children of transients who will remain in the county for at least 21 days will be eligible to receive the inoculations. Injections will be limited to the stipulated age groups (documentary evidence of age or place of residence has not been required).

(3) Globulin will be given to noncontacts of cases only at the mass inoculation clinics and none will be available for administering in the private physicians'

offices. Inoculation will be given on a first-come, first-served basis. Parents should take children to the clinic nearest their home where possible. Contacts of poliomyelitis cases should be taken to the family physician who is able to obtain globulin from the local health department's supply earmarked for use among contacts of cases.

(4) Every effort will be made to avoid crowding at the clinics, but children with communicable diseases should not be brought to the clinics.

(5) One parent may accompany each child through the clinic.

(6) Children should be dressed as simply as possible to facilitate undressing on the injection tables.

(7) All inoculations will be given in the right hip.

(8) In the case of exceptional children, or those with chronic illness, crippling, or other conditions, the parent should consult the family physician if there is any question as to the desirability of having the child inoculated.

(93 Bamma globulin is harmless in most cases; some few children may experience headache, fever, chills, pain, or swelling about the inoculation site. If these reactions occur, the parent should consult the family physician.

OPERATIONS (TRANSPORTATION, COMMUNICATIONS, ETC.)

Due to the complexity of the organizational and operational setup of the mass inoculation program, the entire time of the local health officer and the State consultant is required to keep the clinic program operating smoothly. When actual operations begin, it proved essential that one of these two individuals remain on duty at the command post at all times. The other circulated from clinic to clinic generally supervising field operations.

Distribution and flow of supplies was one of the most difficult phases of the program. Due to the ratio of children to syringes which are supplied, it is necessary to clean, pack, and reautoclave syringes while the operation is in progress. All autoclaving was carried out without charge by local hospitals. In each county a supply depot was created at the local health department and supply transport corps was set up by the National Guard in two counties and by volunteer workers in the third county. Communications between the clinics and the health center were maintained by telephone and by short-wave radio in every county. The radio was necessary to avoid the overtaxing of telephone facilities at the health center. Radio sets and operators were volunteered by National Guard units and other groups and their location in the clinics and health center greatly facilitated communications. This procedure is recommended for any operation of this type.

CONTRIBUTION OF THE NORTH CAROLINA STATE BOARD OF HEALTH

The role of the State health organization in the North Carolina globulin clinics varied slightly from county to county. In every county, however, the program was recognized as being of local origin and a local responsibility. The county health department was the official agency in charge of all operations within the county. The role of the State board of health may be defined as:

(1) Supplies consultation through the communicable disease control section of the division of epidemiology for the health officer in the organization, plans, and staging of the clinic. The health officer also receives assistance in the administration of the program. The field epidemiologist assists the local health officer in the investigation, collection, and tabulation of epidemiologic data relative to the poliomyelitis outbreak.

(2) Recruits professional personnel, both physicians and nurses, from other local health departments and medical centers in the State.

(3) Serves as the official channel of communication with the Office of Defense Mobilization, the Public Health Service, and the National Foundation for Infantile Paralysis.

(4) Through the public relations officer in the Raleigh office, assists in the release of public information relative to the poliomyelitis incidence and the gamma globulin program.

(5) Provides plans, program, and personnel for the evaluation of the possible effect of gamma globulin on the poliomyelitis incidence, on the administrative aspects of staging a mass inoculation clinic, and on the allocation and distribution of gamma globulin.

CONTRIBUTION OF THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS

Since the National Foundation for Infantile Paralysis is interested in the general field of poliomyelitis, and since several of their workers are usually present in the county where a mass inoculation program is contemplated, their role in the operation may be defined as:

(1) Supplies of loan syringes from the New York office which must be wrapped and returned at the close of the clinic.

(2) Provides disposable needles, syringe cleaners, Steri-wraps, and rubber bands from the New York office.

(3) Pays expenses of professional personnel. (This practice has now been discontinued.)

(4) Assists in the orientation of lay volunteers through showing of movie, Marbles and Lollipops, at the mass meeting of volunteers.

(5) May assist in the procurement of supplies from local sources. (This does not mean financial assistance in every instance.)

(6) May assist lay workers in some phase of the clinic operation.

(7) On request, may supply a press agent or public relations expert to assist the local health officer with publicity.

(8) Supplies foundation literature dealing with globulin for distribution at the clinics.

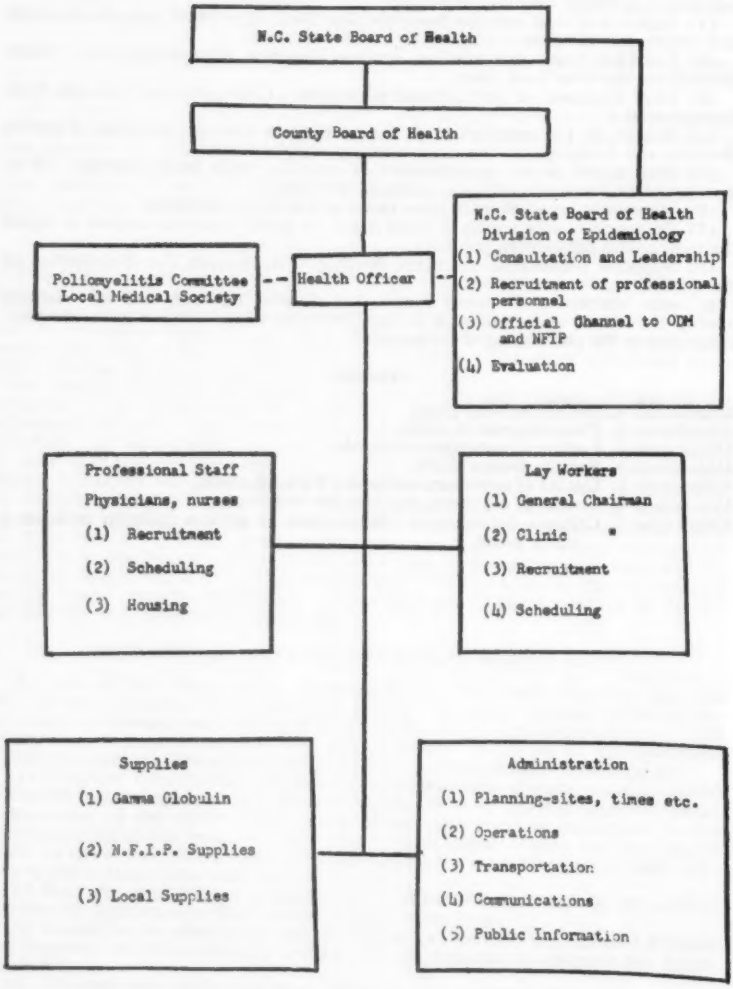
In some instances, the local foundation chapter has supplied lay workers during the clinic operation and in one case the local chapter gave financial assistance in the purchasing of the supplies.

APPENDIX

Attachment 1. Organizational plan.
Attachment 2. Flow diagram of clinic.
Attachment 3. Listing of personnel required.
Attachment 4. Sample dosage chart.
Attachment 5. Listing of minimum equipment for each clinic.
Attachment 6. Listing of minimum supplies for each clinic.
Attachment 7. Criteria determining effectiveness of gamma globulin used on a mass basis.

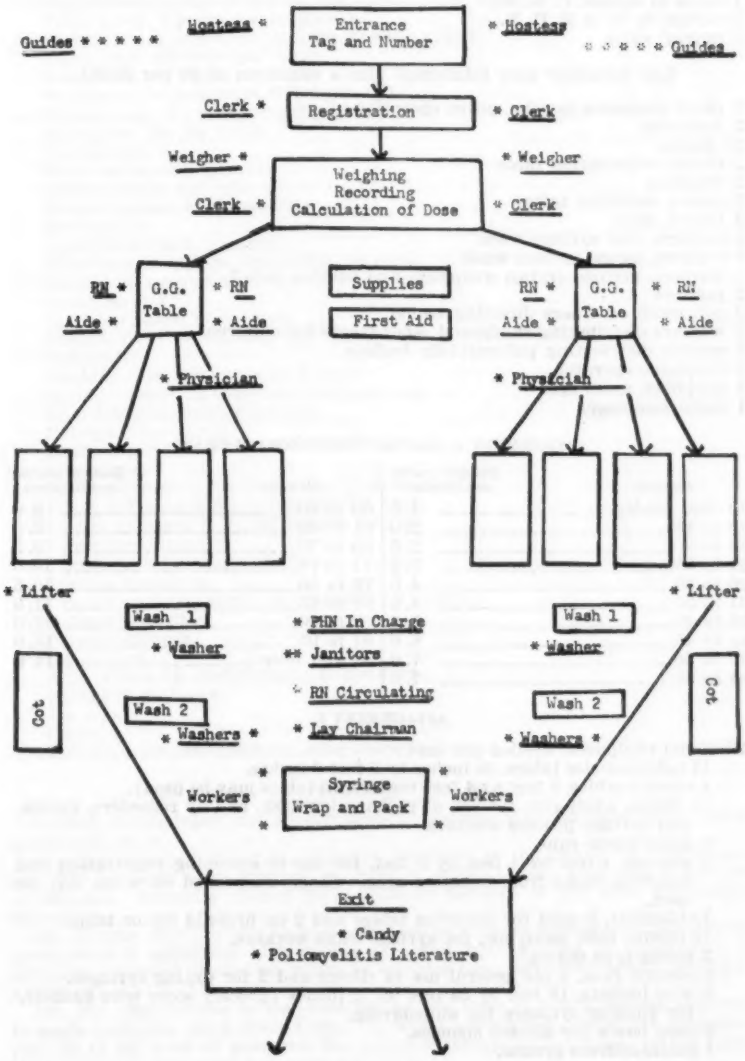
Attachment 1

ORGANIZATIONAL PLAN



Attachment 2

FLOW DIAGRAM



ATTACHMENT 3. PERSONNEL REQUIRED FOR SINGLE BASIC CLINIC

Professional unit

2 physicians
1 nurse in charge, P. H. N.
5 nurses, R. N. or P. H. N.
4 nurses' aides

Lay volunteer unit (chairman plus a minimum of 40 per shift)

1 clinic chairman for the entire operation
2 hostesses
10 guides
2 clerks, registration table
2 weighers
2 clerks, weighing table
2 lifters, male
2 workers, first syringe wash
4 workers, second syringe wash
4 workers, syringe drying, wrapping, and packing detail
2 janitors
2 policemen or others directing traffic
2 workers distributing candy and other treats for children
1 worker distributing poliomyelitis leaflets
1 telephone operator
1 telephone messenger
1 radio messenger

ATTACHMENT 4. SAMPLE WEIGHT-DOSAGE CHART

Pounds	*Dosage (cubic centimeters)*	*Pounds*	*Dosage (cubic centimeters)*
10 and under	1.5	56 to 60	8.0
10 to 15	2.0	61 to 65	8.5
16 to 20	2.5	66 to 70	9.5
21 to 25	3.5	71 to 75	10.0
26 to 30	4.0	76 to 80	10.5
31 to 35	4.5	81 to 85	11.0
36 to 40	5.5	86 to 90	12.0
41 to 45	6.0	91 to 95	13.0
46 to 50	7.0	96 and over	14.0
51 to 55	7.5		

ATTACHMENT 5

Minimum equipment needed per unit:

14 cafeteria-size tables, 30 inches by 5 feet 6 inches.
4 smaller tables, 3 feet by 4 feet (cafeterial tables may be used).
12 chairs, adult size, for use at registration desk, and by recorders, nurses, and syringe process workers.
6 large waste cans.
8 screens, 4 feet by 4 feet by 5 feet, for use in screening registration and weighing desks from injection area. Sheets suspended on wires may be used.
10 blankets, 8 used for injection tables and 2 on first-aid cot or table.
12 basins, pots, pans, etc., for syringe wash workers.
2 spring-type scales.
6 electric fans, 4 for general use in clinics and 2 for drying syringes.
6 wire baskets, 18 feet by 24 feet by 12 inches (grocery store wire basket), for packing syringes for autoclaving.
6 soup bowls for alcohol sponges.
1 public-address system.

ATTACHMENT 6

Minimum supplies needed per unit:

Syringes, ¾ 10 cc. ¼ 5 cc. (at least 500 total).
Needles, 1 per child.
Alcohol, 12 pints per 1,000 children inoculated.

Minimum supplies needed per unit—Continued
Cotton balls, 4,000 per 1,000 children.
String tags, 1 per child.
Safety pins, 1 per child.
Registration cards, (3 by 5 inches, plain), 1 per child.
Paper towel, 6 packages, minimum.
Sheets, 12 per clinic (for gamma globulin tables).
Paper cups, 100 cups per clinic.
Scissors, 2 per clinic.
Roll paper, 30-inch wide, 6 feet per child.
Elastic tape, 18 yards per 8 injection tables.
Band-aids, 100 per clinic.
Stethoscope, 1.
Blood pressure apparatus, 1.
Rubber bands, 1,000 per clinic.
Guaze squares, 1,000 per clinic.
Bar soap, 6.
Liquid detergent, 1 gallon.
Envelopes or syringe wraps, 500 per clinic.
Stapler (if envelopes are used), 2 per clinic.
Extra staples.
Syringe opener, 1 per clinic.
Pencils, red (for marking tags and gamma globulin dose), 12.
Pencils, 12.
Masking tape, 100 yards by ¾ inch.
Syringe cleaner, 2 boxes per clinic per day.
Globulin dose chart, 4 per unit.
Forceps, 2 per clinic.
Pliers, 2 per clinic.
Emergency tray:
3 2-cc. syringes 3, No. 26 needles ¾ inch.
1 5-cc. syringes 3, No. 20 needles 1½ inch.
1 10-cc. syringes 1, No. 22 needles 3 inch.
6 ampules adrenalin.
6 ampules sol. phenobarbital.
1 bottle benadryl.
1 bottle aromatic spirits of ammonia (4 ounces).
1 dozen band-aids.
Alcohol sponges.
Tourniquet.
Soft drinks, for staff working in the clinic.
Packaged crackers.
Ice cream.
Candy.
Lollipops, etc., for children being inoculated.

ATTACHMENT 7

Factors determining the effectiveness of gamma globulin used on a mass community basis:

(1) The efficiency of gamma globulin decreases as the attack rate decreases and will be much more efficient in areas in which a very high attack rate is anticipated. Intensity rather than ultimate severity is the most important factor.

(2) Gamma globulin will be more effective in a dense homogenous population group with a uniformly high attack rate and less effective in areas with a diffusely scattered population which at any one time may have widely differing attack rates.

(3) The effectiveness is also modified by the time at which gamma globulin is made available on a mass basis. In small population groups the epidemic may be in its peak or past and the entire outbreak on the wane by the time the material is requested and made available.

(4) In the initial field trials the use of gamma globulin was limited to those age groups expected to have the highest age-specific attack rates, and broadening the age limitations to include the older age children would again reduce the effectiveness of mass use of the product.

(5) The effectiveness of globulin may be modified by the length of time necessarily consumed to administer the product to large groups of children since it is based on the principle of the simultaneous transformation of large numbers of susceptible children into temporarily immune children. For this reason, it is required that any mass inoculation program be completed within 10 days after it is inaugurated.

Mr. CARLYLE. Dr. Norton, did this reach an epidemic stage in these two counties in North Carolina?

Dr. NORTON. Yes, sir; we had a set of criteria which we had to meet in order to qualify for the use on a mass basis, and in each 1 of these 3 counties we met those criteria. You will find that one of the things we did was to have a request from the county medical society which knew the local situation better than anybody else would know it. A request was sent in that they felt it had reached that stage and they would like to see it available to the people in that county, and along with that recommendation and information on page 2, it was required as has been brought out to some extent, we asked them to give the total number of cases, with the age distribution, the onset of the cases by degree, the number of deaths from poliomyelitis up to that time, the ratio of paralytic cases to nonparalytic cases and the number of respiratory cases.

One of the things which we have learned, which is contrary to some opinion, is that polio actually does occur 12 months in the year. It does reach a low period along usually in March or April and it does reach a peak when it is high of course in an outbreak and then does tend to go down.

Mr. CARLYLE. Let me ask you this question: Did you have this experience or epidemic in all three counties?

Dr. NORTON. Yes, sir.

Mr. CARLYLE. Did those three counties adjoin?

Dr. NORTON. Yes, sir.

Mr. CARLYLE. Now give us some idea as to the age of the people who were affected.

Dr. NORTON. The great majority of cases occurred under the age of 10 years.

Mr. CARLYLE. Well, were you able to determine whether there had been any close communication between these children in the three counties?

Dr. NORTON. I hardly know how to answer that, other than to say there are good roads and good communication all the way up there. It is in a mountainous section of the State, but we do have good roads and they do pass around among each other, particularly during the summer season.

Mr. CARLYLE. Do you recall about how many cases of polio existed? This was in June or July of this year, was it not?

Dr. NORTON. The first case was along in July, I believe.

Mr. CARLYLE. Do you recall about how many cases existed in Catawba County?

Dr. NORTON. There were 37 at the time we started giving the inoculation, and the total report to date is 99.

Mr. CARLYLE. Did you find it necessary to quarantine either of the counties?

Dr. NORTON. No, sir. That has been discussed from a State standpoint and a county standpoint. We do not feel that that would be helpful.

Mr. CARLYLE. It is known that the epidemic was brought under control?

Dr. NORTON. It so happens, as I referred to, the cases go up to a peak, and by the time we had a sufficient number of cases to qualify for the mass inoculation, actually it was beginning to level off and perhaps even beginning to drop down at that time and, of course, the decline continued.

We would have to do a lot of analyzing and it probably will take quite some time yet before we can evaluate just what effect—whether it made it come down faster or whether it would have, as Dr. Anderson brought out, come on down as it always does along toward the end of the summer season.

Mr. CARLYLE. I believe that is all, Mr. Chairman.

Mr. DOLLIVER (acting chairman). Would not that indicate, Doctor, that perhaps the formula for administering or allocating this serum to the affected counties might need some revision?

Dr. NORTON. That is a good question and it is one that I have asked myself. The problem is this: We have over 3,000 counties in the United States and we do not know until they actually begin to build up which counties we will actually have trouble with, and we do not have enough to go around to all 3,000 counties. We have to wait until it actually builds up beyond what we would like to see it before we begin to do this, otherwise we would not be able to do anything at all.

Mr. DOLLIVER. It is a very difficult problem.

Dr. NORTON. Yes; it is a very difficult problem with which to deal.

Mr. PRIEST. Would the gentleman yield? I have just one further question on that same subject, Doctor.

Do you mean that the allocation to the State health department is subject to a limitation of so many cases within a county before that county can receive mass inoculation? I understood earlier that there was an allocation made to the various State health departments and that the head of that department could do with it whatever he wanted. I was just trying to find out where that limitation came in.

Dr. NORTON. The limitation is that we have a certain amount allocated to us for contacts in a certain area. If it looks as if we will have a near epidemic in an area, then we can get a special allocation which would come to the proper people in an emergency for the mass innoculation. They are two separate things.

Mr. HESELTON. Doctor, I want to compliment you on what I consider to be a mighty thorough piece of work and undoubtedly which will be useful in many respects.

Mr. KLEIN. Doctor, I believe you stated that you administered this to about 30,000 children?

Dr. NORTON. Yes, sir.

Mr. KLEIN. Was that given to all the children under 10 years of age in those 3 counties?

Dr. NORTON. Yes, sir.

Mr. KLEIN. Did you have any difficulty in obtaining the necessary amounts of gamma globulin?

Dr. NORTON. No, sir. We made an estimate of the number of children by age groups from the census that we had available and passed that information along and the material was forwarded to the necessary sources.

Mr. KLEIN. Who makes the determination on the State level as to whether there is an epidemic or an epidemic about to take place? Do you, or is it done down in the public-health department down here?

Dr. NORTON. We have certain criteria to meet in that there are a certain number of cases per 100,000 population, we will say, and then also in addition to that you must have a statement by the county medical society that in their opinion it would be helpful in their particular situation.

Mr. KLEIN. Is it then up to the people down here to give you the extra allocation?

Dr. NORTON. Yes, sir.

Mr. KLEIN. Just your statement, in other words, that there is an epidemic in the State is all that is necessary for you to get it without any further difficulty; is that correct?

Dr. NORTON. The fact that there has been a sufficient number of cases to meet the criteria and the furnishing of detailed information which I referred to, and which is referred to in the paper which has been submitted, and then the county medical society saying they want it. They then pass the information to me as State health officer and I pass the information to the Office of Defense Mobilization.

There was a recommendation for approval of our request in all three cases by the county medical societies, and within 5 days from the day the county medical society passed the recommendation they were actually given the material. It was not 5 days until the whole clinic was organized and material was ready and we had voluntary workers and physicians from the 3 medical schools and nurses from various health departments scattered through the State, all organized and ready to go within 5 days.

Mr. KLEIN. May I ask a question of the gentleman from the Office of Defense Mobilization?

Have you ever seen any cases where the States have used up their allocation, not in mass inoculations, but in ordinary cases, and they have a need for more? Do you give it to them then?

Dr. NORTON. There is provision in the plan for additional allocation of the basic amount in addition to their current needs. I believe Dr. Paffenbarger could tell you what States may have qualified for additional allocations.

Dr. PAFFENBARGER. Allocations have been made to 48 of the States and Territories—48 of the 52—and there have been no special requests for material from States which have exhausted their supplies. In fact, to our knowledge, no State has ever seriously endangered its supply and adequate quantities have been provided to meet their individual needs.

Mr. KLEIN. I thought perhaps there may have been certain States who were loath to permit the administration of this drug because they wanted to conserve the amount or because they did not think it was really necessary.

Dr. PAFFENBARGER. I am not sure that I can adequately answer the question, not being at the State level and not knowing what reasoning is taking place, but it would seem to me that both possibilities exist. At the State level no one is sure just how many cases are yet to come in the course of a year. The States would not know how much additional material would be provided them as of any future date.

Mr. KLEIN. The reason I bring it up is because of the apparent reluctance of the New York authorities at the time of these 2 or 3 incidents we had in New York City to use it, and I was just wondering that although they had sufficient quantities whether they did not want to endanger that amount because they felt it might not have been necessary.

Dr. PAFFENBARGER. I think that is part of it. They were afraid if they gave gamma globulin to all the members of the housing project that that particular action would not seriously endanger their supply, but it would establish a precedent which, in the future, would mean all other housing projects with cases would be eligible for the material.

Mr. KLEIN. Just one final question: Where a State health officer, such as Dr. Norton here, advises you, or whoever it is that has to be advised down here, that there is a possibility of an epidemic and he wants additional amounts for mass use, is it usually granted on his statement alone? It is not checked on here at all, is it?

Dr. PAFFENBARGER. No, it is checked here. In other words, the State will make a request for gamma globulin to immunize the children in a certain county and will provide to the national authority the following information: The total number of cases that have occurred; the total number of cases since March 28, which is the beginning of the polio season which has been arbitrarily set; the number of paralytic cases; the number of nonparalytic cases; the number of deaths; and the number of respiratory cases. In addition, it is appreciated if they supply two other points of information: the age distribution of cases and the actual site of the cases. In other words, are they all within one city or within a county, or are they fairly well scattered or is there some other distribution?

If the county for which this request is made meets 4 criteria—if they have had 5 cases since March 28 and if they are expecting to have 20 by the end of the year and if they equal or exceed the poliomyelitis incidence and if they have a rise in trend and if gamma gloublin is available—they are qualified for an allocation and will receive a quantity in cubic centimeters of no greater than 10 times the number of children less than 15 years of age in the county concerned. There is one other requirement which is included in the regulations, and that is that gamma globulin allocated for this purpose must be used within a 10-day period from the time of the request—from the time the request is honored—and any remaining at the end of that time must be returned to the national pool, or at least we must be notified of the quantity remaining.

If the county in which the mass program takes place runs out of material and if for some reason an inadequate quantity was supplied to immunize the children specified as eligible, then, where possible, the national authority provides enough additional gamma globulin to complete the program.

Mr. KLEIN. It is possible, is it not, for you people down here to disagree with the local health officers or the State health officer as to whether there is an epidemic?

Dr. PAFFENBARGER. Yes, sir.

Mr. KLEIN. Or, you can disagree with them as to whether it is really needed?

Dr. PAFFENBARGER. Yes, sir. During this summer there have been 28 requests for gamma globulin to be used for mass prophylaxis pur-

poses. Twenty-three of these requests were honored and five were disallowed.

Mr. HESELTON. Will the gentleman yield for 2 or 3 questions?

Mr. KLEIN. Yes.

Mr. HESELTON. Is there any charge made to the individual for the gamma globulin in cases of mass inoculation?

Dr. NORTON. There is no charge in either case.

Mr. HESELTON. Have you encountered any resistance on the part of individuals or individual families to these inoculations?

Dr. NORTON. No, sir; I think it has been the other way.

Mr. DOLLIVER (acting chairman). Are there any further questions, gentlemen?

Dr. ANDREWS. Again I express my regrets that we cannot amplify Dr. Norton's account of his experience in North Carolina with Dr. Korns on account of the New York experience. I am sure it would be interesting to the committee, but it will doubtless make its appearance in the form of a written statement and will be available in that form.

The Public Health Service has, in addition to the responsibilities about which you have already heard in regard to the gamma globulin, another concerning the biological control of this material from the standpoint of its quality, and Dr. Haas, of the National Microbiological Institute, will tell you something about that.

STATEMENT OF DR. VICTOR HAAS, DIRECTOR, MICROBIOLOGICAL INSTITUTE, UNITED STATES PUBLIC HEALTH SERVICE

Dr. HAAS. Mr. Chairman and members of the committee, gamma globulin is a biological product and, therefore, it is subject to the Biologics Control Act—a Federal law which dates back to 1902—which in its current form imposes on the Department of Health, Education, and Welfare the responsibility for assuring the potency and safety of all biological materials which are used in interstate commerce.

The Public Health Service—and more specifically the National Institutes of Health—administers the law for the Department. A little less than a year ago—last December—we were confronted with respect to this law with an interesting and somewhat acute problem. We knew that there would be great public demand for this product—gamma globulin—and, of course, we were aware of our responsibilities to make certain that what the public received was what they were supposed to receive; that the gamma globulin was in fact what it was supposed to be; that it had some specific activity along the lines for which it was suggested.

We had to meet this responsibility in such a way as not to delay the release of the materials so that they could be made available in time for suitable use, but at the same time to assure that it would conform to the necessary standards.

A number of technical problems were involved in meeting this situation because poliomyelitis is a disease caused by at least 3 different viruses, and we were confronted with the question as to whether we must require the manufacturer to show that the gamma globulin in each instance actually could be demonstrated to be effective against each of these 3 viruses or whether as an alternative we might select

1 of those as a test virus and release the product on the basis of activity against the selected one.

We asked for and received the advice and cooperation of many nongovernmental scientists in this field, and as a result of their advice and our own opinions, we decided gamma globulin could be released upon evidence that it contained antibodies against a single selected strain—the so-called Lansing strain of poliomyelitis virus. That type could be tested in mice. This in itself was an important decision because, if we insisted upon tests against all 3 strains, we would then have to devise some means by which these tests could be carried out, since 2 of the strains were currently not suitably adapted for experiment in small animals such as mice.

At any rate, we decided upon testing against this single strain—the Lansing strain. Facilities were set up in our own laboratory and in the laboratory of the producers so that tests could be performed in accordance with standard procedure.

The gamma globulin used by Dr. Hammon and his associates, which was previously referred to this afternoon, was taken as the standard, and now all gamma globulin released for use in poliomyelitis is tested against the standard in the form of that original gamma globulin.

There are a number of technical questions which must be answered in relation to each lot, and I will not go into those unless the members have specific questions, but suffice it to say, each lot must be shown to be not only potent—the matter which I have already referred to, but it must possess a specific activity and it must be shown to be safe and not contaminated and not to contain materials which would be harmful to the human beings into whom it is to be injected; it must be shown to be, in fact, human gamma globulin, and it pass other standard tests for bateriological sterility and have stability.

I would like to conclude by offering to answer a question which came up, Mr. Chairman, earlier this afternoon, originating both from Mr. Heselton and Mr. Klein, about the length of time for which gamma globulin is acceptable. If I may, I would like to read the official regulation in regard to this matter:

> The expiration date of poliomyelitis immune globulin shall be not more than 3 years after date of manufacture or the date of issue, provided that the date of issue is not more than 3 years after date of manufacture and provided that the product has been kept constantly at not exceeding 5° C.

Mr. DOLLIVER (acting chairman). Are there any questions, gentlemen?

Mr. HESELTON. Are there other uses for gamma globulin besides the attempt to prevent poliomyelitis and measles?

Dr. HAAS. Hepatitis is another use. It is used also in the prevention of hepatitis.

Mr. HESELTON. What is that disease?

Dr. HAAS. That is a disease of the liver referred to sometimes as infectious jaundice or a form of jaundice caused by a virus transmissible from person to person.

Mr. HESELTON. Are your requirements for the use of it in regard to measles and hepatitis fully met?

Dr. HAAS. Yes, sir; the requirements are somewhat different, however, as you would expect. With respect to poliomyelitis we require, as I said, evidence that there are antibodies against a strain of poliomyelitis virus. With respect to measles and hepatitis, however, we do

not require evidence of specific antibodies against those diseases. We require evidence of two separate antibodies and the manufacturer is virtually free to select several antibodies which he wishes to demonstrate. He may choose antibodies against diphtheria or against whooping cough or influenza, just so long as he selects 2 and can show that his lot to be released contains antibodies against those 2, and we accept his protocol or repeat his test, as the case may be.

Mr. HESELTON. How is the use of gamma globulin in connection with measles and hepatitis controlled, if it is controlled?

Dr. HAAS. In each instance there is issued by our laboratory of biologics control a set of regulations which we call the minimum requirements. For each type of product the minimum requirement must be passed by the product and also there are minimum conditions under which it must be manufactured and as to how it must be labeled and many other details of that sort. With respect to gamma globulin there are 2 sets of minimum requirements, 1 for poliomyelitis and 1 for another phase which can be used for these other diseases.

Mr. HESELTON. But there are no other organizations similar to the infantile paralysis organizations which pass on it?

Dr. HAAS. No, sir.

Mr. HESELTON. That goes directly to the physician or the State health officer?

Dr. HAAS. In the past that has been available to the physician through his normal channel of supplies. It is now a part of the national pool.

Mr. PRIEST. Doctor, without mentioning any names, has it been your experience so far that any appreciable quantities of gamma globulin have been rejected?

Dr. HAAS. No, sir; they have all been very gratifyingly potent.

Mr. PRIEST. That is all, Mr. Chairman.

Mr. DOLLIVER (acting chairman). If there are no further questions, Dr. Andrews, you may proceed.

Dr. ANDREWS. There is one bit of information which Dr. Stokes can contribute, I believe, from the standpoint of durability of the potency of gamma globulin.

Dr. STOKES. Mr. Chairman, I think it might be worth mentioning that in relation to hepatitis and measles, there is no animal I know of except man that is susceptible to these two viruses. Monkeys occasionally do take the disease, but not readily, so that one cannot determine the antibody content of the gamma globulin in those two diseases. It has to be determined in the field in epidemics.

It might be interesting to note that gamma globulin has been tested over a period of 7 years by Dr. Enders and gamma globulin which was prepared 7 years previously has shown no evidence that he has been able to obtain of any deterioration in the amount of antibodies in the gamma globulin.

Mr. KLEIN. Dr. Stokes, I have a question I think you might be able to answer.

I believe you said this morning and it has been said here that this gamma globulin can be used for measles. Does that mean you would administer it to prevent a patient from getting measles or getting a very mild case of it?

Dr. STOKES. It is used preferably to give the child a mild case so that he would be permanently immune; that is similar to our effort in polio.

Mr. KLEIN. I know that something was given to my children—I do not know whether it was gamma globulin or not, but they broke out with a mild rash and then were over the measles. Is there enough gamma globulin to be used for that purpose?

Dr. STOKES. I believe so. There has been no limitation on the gamma globulin with respect to measles. Enough has been set aside to handle the necessary injections.

Mr. KLEIN. Does a doctor get it through the Office of Defense Mobilization?

Dr. STOKES. Through the State health officers in the same way that it is used for polio.

Mr. KLEIN. That must mean that an awful lot is used for that purpose.

Dr. STOKES. Yes, a great deal.

Dr. NORTON. One of the limitations, of course, is that a great many of the parents do not know when that child is exposed. If they knew all the time when the child was exposed, a great deal more of it would be used.

Dr. AUFRANC. I would like to clarify one question with respect to its release for measles and hepatitis. The plan does take that into consideration and the application for all diseases gives a first priority to measles and infectious hepatitis. It does take a considerable amount, but it did not this year take too much away from the need in cases of poliomyelitis. We take into consideration the total supply of gamma globulin for all diseases.

Mr. KLEIN. It would seem to me, gentlemen, that measles is rarely if ever serious and all you do by using this gamma globulin is to make the disease a little milder, and if we need it so badly with respect to polio, then possibly it ought to be conserved for that purpose. I do not know whether anyone would want to comment on that or not.

Dr. ANDERSON. May I comment on that? I wish I could agree that measles are not serious, but we have lost many more children from measles than we ever have from polio.

Mr. THORNBERRY. Doctor, let me ask you one question. I am sure it has been answered, but it has been in my mind, and that is the point beyond which you would not go in giving inoculations of gamma globulin in a case of contact. I mean, if a person has already contracted polio, would you give it to him to minimize it? If a person has been in contact with polio and you know he has it, would it be given to him to try to minimize the paralysis?

Dr. STOKES. I would rather Dr. Anderson would answer that difficult question, because I do not think we have a real answer to that. The incubation period is 7 to 14 days and the individual might come down in 7 days, in which case it might well be too late.

Mr. THORNBERRY. Is it known for certain that after he gets fever it is too late?

Dr. STOKES. No; it is not known for certain, but in all probability it would be too late.

Mr. THORNBERRY. Let me ask you this: I understood from the testimony of someone today that there is about a 5-day period in which there is not much you can do for a person with polio?

Dr. STOKES. Yes, sir.

Mr. THORNBERRY. During that 5-day period you could not do any good with gamma globulin; is that right?

Dr. STOKES. Well, there was a study done by Perkins in New York State in the giving of large doses of gamma globulin in preparalytic cases with alternate controls to determine whether the disease would be minimized by the giving of large doses of gamma globulin, and there was no real evidence that gamma globulin was effective.

Mr. THORNBERRY. Thank you.

Mr. DOLLIVER (acting chairman). Dr. Andrews, you may proceed.

Dr. ANDREWS. I think it has been made abundantly evident that 1953 was a trial year from the standpoint of gamma globulin administration for polio, and it becomes very important, therefore, to set up some mechanism for measuring its effect. There was some scientific evidence available regarding mass inoculations from Dr. Hammon's work, but insofar as giving gamma globulin on a contact basis, it seemed to be little more than a very reasonable and persuasive probability; it remained to be proved as to its efficiency. So an organization known as the Gamma Globulin Evaluation Center has been established in the Communicable Disease Center at Atlanta and Dr. Alexander Langmuir, who is the chief epidemiologist of the Communicable Disease Center, will tell you something of the objectives of this evaluation, the plan of analysis, and our present activities.

STATEMENT OF DR. ALEXANDER LANGMUIR, COMMUNICABLE DISEASE CENTER, ATLANTA, GA.

Dr. LANGMUIR. Mr. Chairman and members of the committee, I am a little reluctant to come before you and talk on this subject, because it implies that I have the answer. Unfortunately, these are going to be exceedingly difficult to come by. We are expecting to gather a very large amount of information, and we have the deadline of January 15 for presentation of our results, but I cannot give you, at present, any answers as to how the actual program has worked in its prevention or modification this year.

I would like to summarize the problem as I see it, and to tell you how we are going about it. I do believe we will have by January 15 a very substantial amount of information to help guide the more effective use of gamma globulin next year.

There is one point that I am not sure has been brought out clearly and that is the effectiveness of gamma globulin in poliomyelitis. We have learned that during 1 week after infection a fairly large number of cases develop in spite of gamma globulin. It does not prevent during that period though it may modify the severity of paralysis. The extent of that modification is still problematic. Dr. Hammon's works show 12 cases coming down the first week after gamma globulin and 16 coming down after gelatin was injected. So, we have actually only 12 versus 16 cases around which to judge whether or not modification occurs, but modification is certainly suggested. So, one of our objectives is to get a maximum amount of information on that one point, because if modification is a true effect within 1 week, then the

returns from gamma globulin administered to household contacts are going to be vastly greater than we can now predict with assurance.

From the second to the fifth week there is good indication of approximately 75 percent protection from paralysis. This is the primary basis of the program. But, it must be remembered that in any community, even one like Dr. Norton's in Caldwell County, which is the largest epidemic so far in this country this year, barely 1 percent of the children in the county develop polio. So, a very large number are being inoculated who would never have developed polio anyway. In Dr. Hammon's studies, he gave approximately 28,000 doses of gamma globulin and an equal number of gelatin injections. Approximately 36 cases of polio were prevented. That is a little over 1.4 cases prevented per thousand gamma globulin injections. The other injected children would not have developed polio anyway. Figuring on the basis of approximately $10 per dose, that means an expenditure of $10,000 for the prevention of from 1 to 2 cases of paralytic polio. That means with a million doses available, say, for use this year—and assuming that an epidemic as severe as those Dr. Hammon studied occurs, we might be able to get from 1,000 to 1,500 cases of polio prevented. The return is very small from the point of handling the basic problem of polio in this country. However, I do not in any way wish to say that this should not be done, but let us view it in total perspective and the cost runs into $10 million or $20 million.

At the Communicable Disease Center, which represents the epidemiological field activities of the Public Health Service, we felt that it was tremendously important to get all the information we possibly could about the utilization of gamma globulin so that the available supply could be used to maximum benefit. There are two plans for use of gamma globulin about which there are strong differences of opinion. The one is whether it should be reserved for epidemic areas; the other distributed only to household contacts. The first would strictly limit use to certain specified areas; it would eliminate all the large cities because none of them have epidemic levels comparable to those Dr. Hammon studied if the other would be applicable wherever polio occurs. The solution this year was a combination of both programs.

It is our objective to mobilize essentially all of our available forces at the Communicable Disease Center—epidemiologists, nurses, statistical groups—into a program to be carried out in cooperation with the State health departments, the American Physical Therapy Association, and the D. T. Watson School of Physiatrics, where the entire evaluation personnel were trained in careful muscle grading of polio cases. Finally, an advisory committee was formed and the whole plan was put before its members and they outlined the kind of program we should follow. This was sent out to the various State health departments and they were asked to participate in the program. A total of 41 States and 3 city health departments are active participants with us.

We were able to mobilize 20 of our epidemic intelligence officers, who are young medical graduates in training, as epidemiologists. They are scattered throughout the country doing generalized epidemiological work. It seemed to us that the most appropriate use of these young men was to get them into this challenging epidemiological work and that it was a basic part of their training.

Mr. HESELTON. What kind of problem did you call that?

Dr. LANGMUIR. Challenging problem. The question of how to use gamma globulin is a challenging thing to an epidemiologist because of the hope of disease-preventive benefits. In addition to the young doctors, 8 nurses were assigned, and 6 statisticians have been employed full time on this program since the 1st of July.

We are approaching it in essentially three ways, and we have assigned men to the counties where mass prophylaxis has been utilized. They have seen every case, verifying the diagnosis, the date of the onset, the age of the patient, and have measured the extent of the paralysis to determine whether the cases are mild, nonparalytic cases, slightly paralytic, or severe cases. They have investigated the cases that have come down after gamma globulin had been administered, and there has been a substantial number of those where we have the exact dates of injection. We have done this now in 12 counties, and have arranged to get this information on each of the 23 counties where it has been given.

The problem is to judge whether the epidemic declines faster or not in comparison to what would have occurred had the gamma globulin not been given. That is a very difficult, in fact, it is a well-nigh impossible question to answer definitely, but by comparing the epidemics with those in the same counties of previous years and of other counties comparable to these in size and terrain, we hope to be able to show whether or not the counties that got mass prophylaxis have terminated their epidemics more abruptly and in a shorter time than has normally occurred in past years.

We expect that there will be great variation and that only an impression can be drawn from this approach, but we do not see how we can do more than to make this basic comparison.

In all counties where gamma globulin was given there has been a shift in the age of subsequent cases to children over 10 years of age who did not receive gamma globulin.

By studying past experience we find this to be a normal pattern. In more than half of the epidemics as time progresses the tendency is for cases to occur in older age groups, and now we have the problem of judging the degree of that tendency and whether there is a greater shift to older age groups in the counties which received gamma globulin prophylaxis.

We have arranged on a national basis through the American Physical Therapy Association, with the assistance of a sizable grant from the National Foundation for Infantile Paralysis, for physical therapists to perform measurements of the severity of the disease and the degree of permanent damage. That will be determined when the patient is improved 60 days after the onset of the disease.

We cannot give you the results of these tests today, because poliomyelitis is generally at its peak in August and September and the patients will be graded in October or late November. We already have records on 64 cases that have come down with polio after getting gamma globulin, and if we can show that those cases are significantly different than the cases which developed just before it is given this will indicate a modification due to the gamma globulin, and we will then have a substantial amount of uniformly collected data in contrast to the 12 cases that Dr. Hammon had last year.

Another large part of our program is the work going on in collaboration with States and 3 cities where 2 or more cases occurred in the same family. These will have the same kind of examinations including the 60-day muscle evaluation that I have mentioned. We have chosen those particular families because they will be the ones in which many have had gamma globulin as part of the contact-prophylaxis program which is going on throughout the country.

We will compare the severity of the disease in cases which get gamma globulin a few days before they become ill with cases that develop before they have a chance to get gamma globulin.

We estimate that we will have 1,000 records of families with multiple cases which will provide more information regarding modification.

The third aspect deals with the collection of descriptive data on the administrative aspects of the problem Dr. Norton has already presented for the areas such as in his State. We will record and analyze the methods of distribution and the problems which have been met and will digest this information into usable form which will be available for the States for easing the administrative aspects of the problem next year.

Mr. HESELTON. What happened in the other States besides those mentioned?

Dr. LANGMUIR. They are mostly the smaller States where the amount of polio may be expected to lead to one or no multiple cases in households, such as in Nevada and the Western States where the facilities are few and the distances of travel are great.

However, if an epidemic had occurred in Nevada, I am sure we would have been called in and would have gone.

Mr. HESELTON. This morning we had a very interesting session with the people from the Sister Kenny Foundation. Are any of your physical therapists persons who were trained at the Kenny Institute?

Dr. LANGMUIR. I am sorry that I cannot tell you where they have been trained. The physical therapists have been provided by the American Physical Therapy Association. We then attempt, as far as possible, to utilize them in the States of their residence. A number of the State health departments employ them, and in certain areas like Kansas City and Atlanta, physical therapists were assigned to us to cover several States.

(Dr. Langmuir's prepared statement follows:)

THE NATIONAL PROGRAM FOR THE EVALUATION OF GAMMA GLOBULIN

(By Alexander D. Langmuir, M. D., Chief, Epidemiology Branch, Communicable Disease Center, Public Health Service, Department of Health, Education, and Welfare; prepared for hearing of the House Committee on Interstate and Foreign Commerce)

The discovery of the value of gamma globulin in the prophylaxis of poliomyelitis, announced by Dr. W. McD. Hammon of the University of Pittsburgh, in October 1952, is one of those rare events when a single well-controlled scientific study lays the basis for a new program of national scope that offers a hopeful approach to a previously insoluble major disease problem.

In view of the scope and cost to the Nation of producing and distributing gamma globulin, the Communicable Disease Center of the Public Health Service felt a great responsibility to sponsor a major program to collect on a national scale the maximum amount of useful information about this new agent. The objective is to learn well before the 1954 poliomyelitis season how the limited supplies can best be utilized.

A national evaluation program was established in collaboration with the Association of State and Territorial Health Officers, the American Physical Therapy Association, and the D. T. Watson School of Physiatrics, affiliated with the University of Pittsburgh School of Medicine. An advisory committee, composed of 17 authorities on poliomyelitis, planned the program and reviews its progress.

A National Evaluation Center was organized in the CDC in Atlanta to direct the activities. A group of 20 epidemic intelligence service officers, 8 nurse epidemiologists, and 6 statisticians were detailed to the program. Prior to their field assignments, these officers received an intensive orientation course including 1 week of training in muscle evaluation at the D. T. Watson School of Physiatrics.

Health departments in 41 States and 3 cities are actively collaborating. Physical therapists who perform the crucially important muscle evaluations to determine the severity of paralysis have been mobilized, trained, and assigned to all study areas by the American Physical Therapy Association with the aid of a grant from the National Foundation for Infantile Paralysis. A standardized muscle-evaluation procedure was developed to provide consistency of data in all study areas.

Two methods of use of gamma globulin have been recommended this year:

(1) Mass prophylaxis of selected age groups in epidemic areas.

(2) Contact prophylaxis of household and possible other contacts of clinically diagnosed cases.

The first method is the only one for which the value has been established by direct scientific observations. It is applicable, however, only to specialized situations of intense epidemics. The second method, contact prophylaxis, has not been established by direct controlled study, but it is generally applicable throughout the Nation. A determination of the relative value of this method, compared with mass prophylaxis, should help in deciding the criteria for utilization of gamma globulin in 1954.

Three general approaches are being employed:

(1) The detailed epidemiologic study of each epidemic area where mass prophylaxis has been used.

(2) The careful appraisal of multiple-case households in all study areas.

(3) The critical evaluation of administrative methods employed in the various States for distributing gamma globulin.

In mass prophylaxis areas, the duration and severity of the epidemic will be compared to previous epidemics in the same or comparable areas to determine whether or not characteristic differences occur that can be attributed to gamma globulin. The extent to which cases occurring after mass prophylaxis appear in older age groups not receiving the immunization will be measured. The severity of paralysis in cases occurring immediately before mass prophylaxis will be compared with the severity of cases which develop in spite of immunization to determine whether or not modification of paralysis has been achieved.

Multiple-case households have been chosen for the evaluation of contact prophylaxis. Household contacts of poliomyelitis cases generally receive gamma globulin immediately following the diagnosis of the first case in the family. This is usually 3 to 5 days after onset. Subsequent cases developing in the household may or may not have received gamma globulin. Thus, by studying multiple-case households, the severity of paralysis among contact cases receiving gamma globulin may be compared with that among contact cases which did not. This evaluation will be based on careful muscle testing performed by physical-therapists, approximately 60 days after onset. It is planned to collect detailed records on more than 1,000 multiple-case households. This aspect of the program will not show the extent to which gamma globulin prevents paralysis, but it is expected to measure the degree to which gamma globulin may modify the severity of paralysis.

The administrative aspects will be studied with the view to learning which of the various methods of distributing, accounting for, and controlling the limited and valuable supplies of gamma globulin that are developed by the States are most practical, acceptable, and effective in actual use.

The program is now in full operation, and proceeding according to schedule. The cooperative relationships of the National Evaluation Center with the participating State and local health authorities are universally enthusiastic. The results of the program are not yet available, because the crucial evaluation depends upon the 60-day muscle tests which are only now being performed in large numbers. The schedule calls for a complete analysis of the records and studies by December 31, with the preparation of a fully documented report for review, approval, and release by the Advisory Committee before January 31, 1954.

The members of the National Advisory Committee are:

Dr. Alexander D. Langmuir, chairman
Miss Lucy Blair, consultant, professional services, American Physical Therapy Association, New York
Dr. John M. Chapman, epidemiologist, Los Angeles City Health Department
Dr. Roy F. Feemster, director, division of communicable diseases, Massachusetts Department of Public Health, Boston
Dr. Thomas Francis, Jr., professor of epidemiology, University of Michigan School of Public Health, Ann Arbor
Dr. D. G. Gill, State health officer, Alabama State Department of Health, Montgomery
Dr. A. L. Gray, director of preventable disease control, Mississippi State Board of Health, Jackson
Dr. Morris Greenberg, epidemiologist, New York City Health Department
Dr. William McD. Hammon, professor of epidemiology, University of Pittsburgh School of Public Health
Dr. Arthur C. Hollister, Jr., chief, Bureau of Acute Communicable Disease Control, California State Department of Public Health, Berkeley
Dr. Robert F. Korns, director, Bureau of Epidemiology and Communicable Disease Control, New York State Department of Health, Albany
Dr. John R. Paul, professor of preventive medicine, Yale University School of Medicine, New Haven
Dr. John D. Porterfield, director of health, Ohio Department of Health, Columbus
Dr. Albert B. Sabin, director, Children's Hospital Research Foundation, Cincinnati
Dr. Leonard M. Schuman, deputy director for division of preventive medicine, Illinois Department of Public Health, Springfield
Dr. Thomas F. Sellers, State health officer, Georgia Department of Public Health, Atlanta
Dr. Jessie Wright, medical director, D. T. Watson School of Physiatrics, affiliated with the University of Pittsburgh School of Medicine

Mr. DOLLIVER. Are there any further questions?

Mr. CARLYLE. Has it been stated how much it costs to manufacture gamma globulin?

Dr. LANGMUIR. The cost of one dose of gamma globulin?

Mr. CARLYLE. Yes.

Dr. LANGMUIR. Could Dr. Grant answer that question?

Dr. GRANT. It is made from fresh blood, and you have to consider that the cost includes the cost of collecting the blood. It costs, I would say, about $9.50, between $9 and $10 for 1 injection, and that is the rockbottom price.

Mr. DOLLIVER. Are there any other questions? Do you have any other witnesses, Doctor?

Dr. ANDREWS. I have no further witnesses, Mr. Chairman.

Mr. DOLLIVER. I am sure every member of the committee, and especially our chairman, would wish me to express our very deep gratitude to Dr. Andrews and the other members of the panel.

I know that you have come here at considerable sacifice of time, energy, and perhaps convenience.

These hearings we hope, and certainly believe, will be of advantage to the people of the United States and to all concerned.

We are very deeply grateful to you for your assistance to us.

The committee will stand adjourned until 10 o'clock tomorrow when I believe we take up arteriosclerosis.

(Thereupon, at 5:12 p. m., the committee adjourned until tomorrow, Wednesday, October 7, 1953, at 10 a. m.)

HEALTH INQUIRY
(Poliomyelitis)

MONDAY, OCTOBER 12, 1953

HOUSE OF REPRESENTATIVES,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
Washington, D. C.

The committee met, pursuant to adjournment, at 10 a. m., in the committee room of the House Committee on Interstate and Foreign Commerce, Hon. Charles A. Wolverton (chairman) presiding.

The CHAIRMAN. The committee will come to order.

The hearings today will be directed to a continuation of discussions begun before this committee on October 6 in connection with poliomyelitis.

We welcome to this hearing the representatives of the National Foundation for Infantile Paralysis, the Public Health Service officers, and other interested scientists and laymen who have so generously given of their time in order that the facts about polio may be made known to the American people and to the members of this committee.

I would like to restate the purposes of this series of hearings having to do with the diseases of greatest importance in America today.

This committee has legislative responsibilities in the field of health. In order to discharge these responsibilities, the committee feels it necessary and appropriate to inquire into the current status of a number of diseases—what things are known about them, what is being done to control them, what research is in process and what is needed, what private and public agencies are engaged in prevention and control programs, what, if anything, needs to be done that is not being done to protect the American people.

In previous hearings, the committee has been tremendously impressed by the testimony that has been given by a number of distinguished witnesses. It has been an encouraging demonstration of sincerity, integrity, and coordinated effort. But the committee has also been concerned about the great gaps in our research knowledge, about the economic loss and human suffering caused by long-term illness, about the failure in some instances to apply the knowledge that is now available, and about the widespread lack of adequate measures to protect the rank and file of the American people from the economic burdens of catastrophic illness.

It is our hope that in today's discussion of poliomyelitis we may get a clear picture of what you gentlemen think we and the American people should know about this dread disease—we, because this committee is keenly aware of its legislative responsibilities and intends to continue to discharge them well, and the American people because they

have every right to know the scope and direction of the national effort to improve the American health. Time and again it is demonstrated that the strength of our democracy lies in an informed public opinion translated into spirited action. The great increases in both public and private health agencies since World War II are witness to the interest of the American people in health matters and their determination to achieve better health for themselves, their children, and children's children.

The conduct of these hearings on health has been in the form of a panel discussion, with a prepared agenda serving as a guide for the remarks of the participants and the questions of the committee.

I understand that you gentlemen have a copy of the agenda and that you have agreed among yourselves that Dr. Albert Sabin of the Children's Hospital Research Foundation in Cincinnati, Ohio, will serve as your discussion leader.

The agenda and a list of witnesses will be made a part of the official record of this hearing.

(The materials referred to follow:)

POLIOMYELITIS AGENDA

I. Purpose of this hearing—statement by the chairman
II. Introduction of witnesses
III. Opening remarks—discussion leader
IV. What is the human dimension of poliomyelitis in United States today?
    How many cases—distribution by age group, area, economic status?
    Number of deaths and extent of disability?
    Disease increasing or decreasing?
V. What is known medically about this disease today?
VI. What are the major private and public efforts in the poliomyelitis field?
    National Foundation for Infantile Paralysis
    Public Health Service
    Others
VII. What are the promising lines of research?
    Amount of research today—projects and total volume
    Past research which has paid off
    Vaccine studies and their relation to gamma globulin
    Factors that may impede further progress
VIII. What are the medical care problems in the treatment of poliomyelitis?
    Financial problems
    Treatment facilities
    Supply of trained specialists
IX. What can be done toward rehabilitation of those crippled by poliomyelitis?
X. What needs to be done that is not now being done to make steady progress on a national and local basis against this disease?

PARTICIPANTS

Dr. Albert Sabin, Children's Hospital Research Foundation, Cincinnati, Ohio
Dr. Hart E. Van Riper, medical director, National Foundation for Infantile Paralysis
Dr. Justin M. Andrews, Associate Chief, Bureau of State Services, Public Health Service, Washington, D. C.
Dr. John R. Paul, Yale University School of Medicine, New Haven, Conn.—(resumed)
Dr. W. McD. Hammon, head of department of epidemiology and microbiology, University of Pittsburgh, Pittsburgh, Pa.—(resumed)
Miss Mary E. Switzer, Director, Office of Vocational Rehabilitation, Washington, D. C.
Dr. John R. Paul, Yale University School of Medicine, New Haven, Conn.
Mr. Raymond H. Barrows, National Foundation for Infantile Paralysis
Dr. Victor H. Haas, Director of the National Microbiological Institute
Dr. Hart E. Van Riper, medical director, National Foundation for Infantile Paralysis

Dr. Charles Wise, professor of physical medicine and rehabilitation, George Washington University College of Medicine, Washington, D. C.

The CHAIRMAN. I would appreciate it, Dr. Sabin, if you and the other members of the panel will stand in turn and introduce yourselves briefly so that the reporter may identify you when you speak and so that you may be known to the members of the committee. If any member of the panel is too modest to tell all he should about his or her background, I will leave it up to you, Dr. Sabin, to supply what modesty leaves out, if you will.

After this general introduction, I would like you to observe the agenda and proceed in whatever way you see fit to develop the subject at hand.

The members of the committee, of course, will want to ask questions from time to time, and I hope the entire testimony may be planned to yield the maximum amount of helpful information.

We regret that two members of the committee are unable to be here this morning because of illness. One is in the hospital. That precludes our having their presence. However, there will be some others here as we proceed.

Dr. Sabin, if you will start by telling us your full name and position and background and that of the others, we will appreciate it.

Dr. SABIN. I am Albert B. Sabin from Cincinnati. I am officially professor of research pediatrics at the University of Cincinnati College of Medicine and have been there since 1939. Before that, I was at the Rockefeller Institute for 5 years, and I have been working on poliomyelitis in one way or another since 1931—about 22 years. I have also been interested in other diseases affecting the nervous system, particularly those caused by viruses.

The CHAIRMAN. We realize that is a very modest statement of your position. However, as you are the discussion leader, I suppose we will have to accept your modesty in that respect.

Dr. Van Riper, we have had the pleasure of your presence before us on a number of occasions.

Dr. VAN RIPER. Thank you, sir.

The CHAIRMAN. But, for the purpose of this record, we would like you to set forth your interest in this subject and the position you occupy and whatever other information you would like to give.

Dr. VAN RIPER. I am Dr. Hart E. Van Riper, medical director of the National Foundation for Infantile Paralysis and have held that position for 7½ years. My background is one of pediatrics, having had my training in pediatrics at Dr. Sabin's institution in Cincinnati.

As you say, Mr. Chairman, we discussed, I think in 1948, some of the problems of infantile paralysis, and I think it is high time we met again to bring your committee and the public up to date on what has happened in these intervening years.

Dr. PAUL. My name is Dr. John R. Paul. My position is that of professor of preventive medicine at the Yale University School of Medicine. Both Dr. Sabin and I became interested in poliomyelitis, I believe, in the same epidemic when New York City was struck in 1931, and we have been working on it at different places ever since. My interest is essentially that of preventive medicine and also the study of the methods in which this disease seems to be spread and how it might be controlled.

Dr. ANDREWS. I am Justin M. Andrews, Associate Chief, Bureau of State Services of the Public Health Service. My particular responsi-

bility in the Bureau is to coordinate research and investigations which are carried out with the view of finding practical information which may assist the State health departments in the diagnosis, the knowing about the spread, and the prevention of communicable diseases.

Miss SWITZER. I am Mary Switzer, Director of the Office of Vocational Rehabilitation in the Department of Health, Education, and Welfare. Our office has the responsibility for rehabilitating the victims of infantile paralysis and other diseases and accidents of people who are unable to go back to work or take their full part in the community through the public agencies for vocational rehabilitation and services to the blind.

Mr. BARROWS. My name is Raymond H. Barrows. I am executive director of the National Foundation for Infantile Paralysis. Essentially, my background has been administrative. I have been with the foundation for about 2½ years, and in the 10 years previous to my coming to the foundation was in the administrative work of the American National Red Cross.

Dr. WISE. My name is Dr. Charles Wise. I am professor of physical medicine and rehabilitation at the George Washington University School of Medicine. My background includes training and specifications in this field as a group F fellow to Harvard Medical School. I am a diplomate of the American Board of Physical Medicine and Rehabilitation. I am particularly interested in the field of poliomyelitis as it relates to physical therapy, occupational therapy, and physical rehabilitation.

Dr. HAAS. I am Dr. Victor H. Haas, director of the National Microbiological Institute, which is in the National Institutes of Health of the Public Health Service. I have been an officer of the Public Health Service for 22 years, and during most of that time I have been engaged in research in the infectious and parasitic diseases.

Dr. HAMMON. I am McDowell Hammon, M. D., head of the department of epidemiology and microbiology at the University of Pittsburgh Graduate School of Public Health. I have graduate degrees from the Harvard University School of Public Health, master of public health, doctor of public health, and began teaching in research in epidemiology particularly involving virus diseases of the central nervous system at Harvard beginning about 1937, then at the University of California until 1950, and then at the University of Pittsburgh since 1950. My interest is quite similar to that of Dr. Paul in attempting to determine the means by which poliomyelitis virus is spread and what can be done to control it, the communiological mechanisms that may play a part and that might be used in attempting to protect against the disease. I am a diplomate of the American Board of Preventive Medicine and Public Health.

Dr. PRICE. I am David E. Price, Assistant Surgeon General of the Public Health Service. My interest is in preventive medicine and public-health administration. I was formerly Associate Director of the National Institutes of Public Health in charge of programs of grants for research and training.

The CHAIRMAN. Now, Dr. Sabin, you may proceed.

STATEMENT OF DR. ALBERT SABIN, CHILDREN'S HOSPITAL RESEARCH FOUNDATION, CINCINNATI, OHIO

Dr. SABIN. According to the agenda, I am scheduled to make a few opening remarks, and since I was told of this conference only a few days ago, my remarks are not printed. I did the best I could to think about what you might be interested in, because I did not know what you might be interested in, while I was coming here on the plane yesterday.

I would like to preface the discussion which is to follow with a very brief outline of the history of the work on poliomyelitis.

The disease has been known for thousands of years, but the cause of the paralysis, which is the important manifestation of this disease, was not appreciated until the latter part of the 19th century, when people working on diseases of the nervous system for the first time demonstrated that the cause of the paralysis is in the central nervous system and that the destruction of those nerve cells which interlace the muscles is the cause of the paralysis. That is a very important and fundamental demonstration, because you cannot bring back nerve cells that have once been destroyed. That is very fundamental to our whole thinking about the disease with regard to bringing back functions to muscles—to paralyzed muscles—that are so badly damaged that they have lost almost their entire nerve supply.

The next important step came about 45 years ago when it was first demonstrated that in the central nervous system—in the spinal cord—there was an agent which could be transmitted to monkeys in sera which reproduced the disease. You should bear in mind that that demonstration was made at a time when scientists did not yet know about viruses at all. As a matter of fact, it was in that same year, about 45 years ago, that the first concern of a virus was introduced by people working on plants, a virus being some agent which at that time could neither be seen nor cultured like other microbes but which was capable of producing disease in plants or animals. I mention that in order to give you an idea as to why it took so many years to make the little steps and progress that were made.

Twenty years followed after the first demonstration that it was such an agent that was the cause of human infantile paralysis without very much knowledge having been accumulated. I will not detail here just what the work in those 20 years was, except to say that it was very limited indeed, chiefly because we did not yet know very much about viruses in general.

Then, perhaps it is my own interpretation of the facts, but an important step forward was made when an American philanthropist by the name of Milbank gave something like a quarter of a million dollars—I am not sure of the amount—to a group of American physicians and scientists and asked them to give it out in such a manner that it would stimulate research on poliomyelitis. That might have perhaps formed the progress made in the next decade from 1928 to 1938, because there were brought into the field people who had not previously worked on poliomyelitis but who were experts in diseases

of the nervous system—experts in virology. During that period they concentrated primarily on the study of the disease in experimental animals. Many new findings were made, and those findings in effect led to two important public-health experiments which some of you may recall.

In the mid thirties there was a test on a vaccine at that time on something like 50,000 or more children. Yes. It was premature, and they were halting steps, but because of certain things that were learned about the disease in animals, it was believed that if the disease in human beings was similar it might be possible to block the virus somewhere in the nose, going in along the nerves. You will recall that big public-health experiments were put on to test the effect of chemicals sprayed into the nose on the invasion of the nervous system. They were failures.

The next decade is the decade which saw a new stimulus to research that might roughly correspond to the entry into the field of the National Foundation for Infantile Paralysis. Here was the entry of funds which were donated by the American public at large, and again that brought into the field people who had never before done research on poliomyelitis. Perhaps I can call the decade between 1938 and 1948 the decade in which scientists turned to the study of the disease in man.

Having been somewhat misled by the study of the experimental disease in animals, they turned with all the tools they had in their possession to study the disease in man, and they brought forth a great deal of new information which will be discussed later which gave an idea about what the virus was doing in man here in America and what it was doing in the world at large.

We also during that period began to learn more about the different types of viruses that might be involved.

Now, I would say that the fourth period corresponds to the period of the last 5 years. Those are the 5 years in which the greatest progress, in my opinion, has been made. In those 5 years the most important steps forward were made, when it was realized that among the hundreds of different viruses that were recovered from human beings and other sources in Nature there was not an infinite variety of different agents causing this disease but, in fact, they could somehow be grouped into 3 different types which would immunize one against the other in 3 major groupings. That was a very important step. That required much money, and the representatives of the national foundation can tell you the heroic effort it represented, but it could not at that time have been done in any other way and we would not have had that information. That became the basis for further studies which would help us understand the diagnosis and an attempt at immunization.

But the greatest step forward was made when it was discovered that the polio virus, which hitherto could be propagated and grown only in very expensive animals, could be grown and propagated in certain tissue. Those studies for the first time have made available sources of information on viruses which were not available before. They have made it possible to go to the laboratory with this agent to find out whether or not there are different varieties of it, some of them weak and some of them strong, some very virulent and some not.

It is these studies which are the foundation and the very beginning of the attempts at prevention and control of the disease, and the nature of those studies will be brought out in the discussion.

Now I would like to say—just let me ask this question: What is needed for control or prevention of poliomyelitis, realizing that it is a worldwide disease not limited to the United States and that the infection is present wherever human beings are present?

First, one needs a method of producing long-lasting immunity similar to that resulting from immunization against smallpox, yellow fever, and other diseases. Second, a simple method for testing people to find out who is immune and who is not. In effect, great steps have already been made toward the achievement of these objectives, as we will find out later during the course of this discussion just how far we have come. I can only say now we already have available tools by which we can tell who is immune and who is not. I do not know, but perhaps it would cost $1 per person now to determine that, but further work on culture could be of such a nature that it would be quite a simple matter to easily find out who is immune and who is not.

The most urgent efforts for the future are to be directed to studies, and in great detail, of the problems involved in immunization with "killed" viruses and with other varieties. The search for more abundantly available sources of tissue for cultivation of viruses is a problem facing us, and the continued search for chemicals which might prevent paralysis in infected people.

Finally, there is the need for a continuation of those studies of the natural history of the disease with newer tools to give us as complete understanding as possible of the disease. To use military terms, "to give us the most complete intelligence of the enemy that we are dealing with," because, while we have learned a great deal during the four decades before, the tools—actually the best tools—have only just now become available.

Now, with this introduction, I would like to say that at a preliminary discussion this morning it was felt that the hearing might best proceed if we could have a brief summary of the statements that have been introduced in the record. I assume that they will not be read in extensio but just to give us an idea as to what is in them, and Dr. Van Riper will present the gist of the statement of the national foundation.

STATEMENT OF DR. HART E. VAN RIPER, MEDICAL DIRECTOR, NATIONAL FOUNDATION FOR INFANTILE PARALYSIS, NEW YORK, N. Y.

Dr. VAN RIPER. Mr. Chairman, since it was impossible to have our statement distributed to the members of this panel, with your permission I think it would be well to proceed because it summarizes many of the things that will later perhaps stimulate questions for the benefit of this group.

The problem in poliomyelitis is crippling; its death rate is relatively low. Since it strikes chiefly at youngsters—small children and teen-agers—a large number of its victims must be cared for many years and many carry a burdensome handicap throughout their lives.

During the years 1938–52, 302,677 cases of poliomyelitis were reported in the United States and its Territories. During the same

years 20,916 deaths were caused by this disease. The estimate for 1953 is 35,000 cases.

Of the victims of poliomyelitis, 50 percent recover completely; 30 percent have no disabling aftereffects, 14 percent are severely paralyzed, and 6 percent may die.

According to a United States Public Health Service report, more children died in 1952 from poliomyelitis than from any other reportable communicable disease.

Recently the national foundation attempted to calculate the risk of contracting clinical poliomyelitis, the diagnosable kind. In 4 representative States from which statistical information was available, it appeared that among children born in 1930, 1931, 1932, 1 out of every 156 acquired poliomyelitis during the first 20 years of life. In those same groups of children, 1 out of every 1,945 died from infantile paralysis before reaching the age of 20. It is obvious, then, that the chance of getting poliomyelitis is not as insignificant as many people believe.

According to the World Health Organization, the relatively low incidence of paralytic poliomyelitis compared to many other infectious diseases is counterbalanced by the permanence of the resulting disability, since treatment, prolonged and expensive as it is, is only a palliative; a nerve cell, once irreparably damaged cannot be replaced.

The National Foundation for Infantile Paralysis from 1938 through 1952 spent $145 million for patient care. By the end of 1953 it is estimated that more than 258,000 patients will have received direct financial assistance, in whole or in part, from the National Foundation for Infantile Paralysis. In 1952 alone the patient-care program expenditures were $24,910,000 for aid to 80,000 poliomyelitis patients, more than half of them victims of previous years.

I think that it is important to note there that the problem of the national foundation and the patient-care program has been the cumulative caseload that has come from previous epidemic years. Even in 1952, with 57,000 reported cases, there was not only the problem of that year alone but the cases that had occurred in previous years.

The average cost of inpatient hospital care of polio patients (per patient day in all general and special short-term hospitals) during the first 7 months of 1953 was $14. The daily average cost of care of a patient in an iron lung is approximately $19. Service to respirator patients can cost as high as $10,000 to $12,000 a year for a seriously involved case. There are more than 1,500 patients today in iron lungs for all or part of each day.

A study of 35,882 notices of original acute admissions reported to the national foundation during the period July 20 to December 31, 1952, showed that: 54 percent were under the age of 10; 23.9 percent were age 10–19; 22.1 percent were 20 and over. Ten percent of the patients were in the age group 30–39; above the age of 40 the percentage becomes minimal. Up to the age of 20 more boys than girls fall victim to this disease; above that age the proportion changes, and of all females in the group studied, 28 percent were in the age group 20 and over.

There is no way of estimating manpower loss accurately in terms of interruption of schooling or denial of playtime for children. The high incidence among women of 20 and over strikes into the group of young mothers, whose loss to their families is incalculable. Per-

manent crippling of the boys and girls under 20 means perhaps 50 years of economic handicap. Recovery periods after a poliomyelitis attack often stretch for months, and some patients cannot be restored to earning power for years, if at all.

The long-lasting effects of this disease are illustrated by our findings during the first 4 months of 1953, that of 6,064 poliomyelitis patients admitted for treatment, 1,031 had their initial attack in 1948 or before; 388 in 1943 or before. During 1953 the national foundation still was paying for care of some victims stricken in the 1916 epidemic.

National foundation records show that 7,756 patients out of the 50,338 aided from July 20, 1952, to January 3, 1953, had a service connection or were from families of veterans.

It should be mentioned that the national foundation chapters carry individual patient care expenses as long as the attending physician believes treatment will bring benefits to the patient and the family cannot pay full costs of essential followup treatment. Maximum recovery usually can be expected within 18 months, but many cases go far beyond this.

A total of 24,217 bills received by the national foundation during January through May 1953, for care of 11,666 patients, showed that the average cost for treatment per patient was $629, of which the national foundation contributed $550 for each. In 1953 the cost was $621 for care of one patient stricken in 1902; $1,458 for care of one patient who had poliomyelitis in 1912. Cost of equipment used is not included.

An iron lung costs from $1,800 to $2,100; a rocking bed from $700 to $1,500. The price of a portable chest respirator and its accessories is approximately $1,250; hotpack machines used in hospitals range from $225 to $400. Purchase of a wheelchair takes around $175, and braces, for leg or back, from $50 to $300. National foundation chapters supply these items to patients and hospitals as required.

A striking illustration of the financial burdens this disease imposes is that of a doctor in Santa Cruz, Calif. He received March of Dimes care at the rate of about $14,000 a year from late 1949 through 1951. In 1952 this was reduced to approximately $5,500 because this physician, though still forced to spend some time each day in an iron lung, had resumed the practice of medicine.

Hospital bills for another poliomyelitis victim for the period April 7 through July 21 of this year amounted to $5,100.

During the years 1938–52 the national foundation allocated a total of $16,400,000 for professional and public education. In 1952 almost $2,400,000 was allocated for this purpose. Of 6,000 physical therapists working in the United States in 1952, almost 2,000 were trained under national foundation scholarships, for which $2,250,000 had been provided.

Funds amounting to $18,100,000 were authorized for scientific research in the years 1938–52; $3,300,000 of this amount in the year 1952. On June 30, 1953, the national foundation announced awards totaling $2,283,384 to 21 universities, medical schools, hospitals, and organizations for research and professional training. Included in this sum was $334,108 for pilot studies to integrate the concept and skills of complete medical rehabilitation at George Washington University School of Medicine, the University of Pennsylvania School

of Medicine, New York University College of Medicine, and Cornell Universiay Medical College.

So far no rapid diagnostic device has been perfected by national foundation grantees but there are signs that research on this subject may produce results soon.

A dramatic and practical contribution of recent years has been support of seven regional respirator centers, located at Houston, Tex.; Wellesley Hills, Mass.; Ann Arbor, Mich.; Buffalo, N. Y.; Hondo, Calif.; Chicago, Ill.; New York City. Several hundred of the most seriously afflicted poliomyelitis patients—those with breathing difficulties—have been grouped for care and study and rehabilitation. In 1952 5 centers discharged 303 of these patients—70 percent of whom were completely weaned from respiratory devices. The sum of $800,000 had been authorized for their operation through December 31, 1952. It is our hope that through work done in these centers many iron-lung patients of the future will be able to live at home and lead useful lives.

During the years 1938–52 administrative costs of the national foundation were $9,200,000, which represents 4.4 percent of funds used.

Financial assistance to poliomyelitis patients who could not pay all or part of the costs of medical care amounted to $145 million from 1938 through 1952. Net proceeds of the annual March of Dimes have been divided between local chapters and national headquarters, the chapters' share being used for patient care, that of national headquarters for research, professional and public eduction, epidemic aid. This practice has been followed throughout the existence of the national foundation. During this period, however, six States, Arkansas, Colorado, Idaho, Minnesota, Mississippi, and North Carolina have had the use of $3,759,010 more than their total net receipts from the March of Dimes. These States spent more than the total funds they had raised; all but three (Connecticut, Delaware, and Rhode Island) of the other 42 States had available for patient care more than their 50 percent share of March of Dimes funds, and only the District of Columbia ended the 15-year period without an advance of funds from national headquarters.

May I explain the use of the word "advance"? When local chapters have utilized all of their funds available, we advance from what we call an epidemic aid fund sufficient funds to carry them through the balance of the year to care for patients.

In 1952, Arkansas, Michigan, Minnesota, Mississippi, Texas, and Wisconsin spent more than their total net March of Dimes proceeds. Statistics for this year show that chapters actually had the use of 71 cents out of every dollar of the net March of Dimes proceeds on a national average, and headquarters only had 29 cents out of every dollar for its programs.

As a recorded disease, polio has a history dating back to 1789. However, there are references in the literature which indicate that the disease had its roots in antiquity. The severe seasonal epidemics, which we now regard as characteristic of the disease, swept the northern European countries in the 1890's, but it was not until 1916 that America experienced its first massive epidemic.

From the early 1900's well into the 1930's there was much scientific interest in the nature of the disease. However, the interest was that

of unsupported individuals who investigated, within their own limited means, those phases of the problem which particularly interested them. As a result, scientific knowledge of the disease was sparse, uncoordinated, and in many important phases, contradictory. Contributing also to the confusion, was the fact that since polio as a virus disease was a relatively new concept in medicine scientists lacked the basic techniques and tools for studying the problem.

In 1938, with the support and guidance of the National Foundation for Infantile Paralysis, there began a scientific plan of attack against polio. It was a plan designed to accumulate the basic knowledge that would ultimately yield a reply to that question asked over and over again by parents and scientists alike, "How can polio be prevented?"

Natural protection against any infectious disease depends on whether a person has in his blood tiny molecules called antibodies. These powerful substances are manufactured by the body following an infection by a germ or other disease-producing organism. Exactly how and where the body manufactures them is still a mystery to scientists, but they do know that each germ induces, by its presence, the production of a special antibody to fight it.

The formation of these protective antibodies, however, does not come about only as the consequence of an actual disease process. Since the days of Edward Jenner, the 18th century country physician who dared to prove that smallpox could be controlled, medical science has demonstrated time and time again that the body can be tricked into the production of antibodies through vaccination.

This can be accomplished either by a live vaccine, as in the case of smallpox, or by an inactivated vaccine, as in typhoid. The smallpox vaccine is composed of the living "cousin" of smallpox, the cowpox virus, which causes a mild, allied form of the disease. The typhoid vaccine is composed of inert typhoid germs that cause no disease but nevertheless stimulate the body to produce special protective antibodies. The advantage of the live vaccine is that it causes quicker and more abundant production of longer-lasting antibodies. The inactivated vaccine, however, is usually the safer preparation.

It has taken 16 tedious years of laboratory investigations, $20 million in March of Dimes contributions, and the cooperative efforts of hundreds of scientists in scores of universities to reach the present hopeful stage in the search for a polio vaccine.

One milestone in that search was reached in 1949 when a scientific journal published an article by a research grantee of the national foundation describing a method for growing polio virus in test tubes that contained bits of nonnervous tissue. Except to the educated ears of polio researchers, there was little in the precise words of the author—John F. Enders, M. D., virologist at Harvard University and the Boston Children's Medical Center—to indicate the tremendous scope and importance of his discovery.

Previously scientists had been able to grow polio virus only in the bodies of certain experimental animals, mainly monkeys. Thus, the virus needed for producing possible vaccines could be obtained only from the infected brains and spinal cords of these animals. But scientists well knew that a vaccine prepared from virus grown in nervous tissue was too dangerous for human use, since nervous tissue injected into man held within it the threat of an illness even worse than polio.

Until polio virus could be produced free of nervous tissue, hope for a vaccine was dim indeed. That is why scientists hailed Dr. Enders' achievement as the end of the monkey era in polio research and the beginning of a new, definite hope for a vaccine.

There was yet another stumbling block in the path of polio researchers. For years they were aware that polio was caused by more than one virus, but no one knew how many types there were and how they differed. Before these facts were known, it was impossible to concoct a vaccine that would be effective against all the kinds of polio virus that caused the disease.

Because of the urgency of this problem the National Foundation for Infantile Paralysis in 1948 embarked on a unique project. Backing its request with a grant of $1,370,000, the foundation enlisted the aid of teams of scientists at four leading universities—Southern California, Utah, Kansas, and Pittsburgh—in a cooperative investigation to determine how many viruses cause polio. Hundreds of specimens of polio virus obtained from patients all over the world were parceled out to the scientific teams for "fingerprinting."

Three years later, in 1951, the task of identification was at last completed. The results showed that there were three major types of polio virus capable of causing the human disease. For the time being they were referred to as the Brunhilde type, named for the chimpanzee used in experiments in Baltimore; the Lansing type, the original of which was obtained from a young man who died of polio in Lansing, Mich., and the Leon type, so-called for a young boy in Los Angeles who also died of the disease.

Though all three viruses produce identical symptoms, infection by one will not induce antibodies effective against either of the other two. This explains why a few unfortunate victims have had polio twice. (Triple attacks of the disease have not been recorded.) Scientists quickly realized, therefore, that the preventive they sought—whether drug, serum, or vaccine—would have to be prepared in such a way as to make it effective against all three types of virus.

I think that it would be well to note there, as I have stated, this original typing program cost in excess of $1 million. It was reported just last week at the meeting of the advisory committee of the national foundation that additional typing programs had been continued using tissue culture, and while some 100 specimens were tested in this original typing program, since then some 200 have been carried through the typing process at a cost of something less than $100,000 for doing twice the number we did in the dim ages before the tissue culture techniques.

Once these and other critical facts were at their command, scientists were able to move at a faster pace. Dr. Enders and others speedily demonstrated that each of the three types of polio virus could be grown in test tubes on various kinds of nonnervous tissue. Rapid improvements in this method have apparently solved the problem of producing enough polio virus for the vast quantities of vaccine that would be required for general use. Recently, scientists have expressed the opinion that there is now no practical limit to the amount of virus that can be produced.

But what troubled many scientists was whether a vaccine for polio—supposing that one could be developed—would actually work. Polio investigators had long believed that the virus usually entered the

body through the mouth and from the intestinal tract made its way by tiny nerve connections to the brain and spinal cord. There was little or no scientific evidence that the virus was ever in the blood stream at any time. Thus it appeared unlikely that a vaccine which induced the production of antibodies circulating in the blood could be effective, if the virus was never present in the blood.

Then early in 1952 came reports of a crucial experiment. Scientists at Yale and Johns Hopkins Universities tested monkeys and chimpanzees experimentally infected with polio virus. Within a few days after inoculation, the virus was found in speciments of blood taken from the animals. True, it remained there for only a brief period before the virus entered the brain and central nervous system and there did its real damage. But the fact that at one stage of the disease the virus was in the blood stream meant that there was a time and place at which antibodies could be effective in protecting against paralytic attacks. In addition, the scientists demonstrated that if small amounts of polio antibodies were administered to the animals shortly before the time of exposure, both viremia (virus in the blood stream) and paralysis would be prevented.

The results of this experiment gave new hope to scientists. While it did not preclude the possibility that in an unknown number of cases virus might attack nerve cells without passing through the blood stream, the finding provided added encouragement for further developmental work on a vaccine.

Also attesting to the belief that a vaccine, when developed, would be effective were the experiences with gamma globulin in field trials financed by the national foundation in 1951 and 1952. The amount of polio antibodies contained in the dose of gamma globulin administered to the children was small indeed. So small that tests barely detected its presence in the children's blood. Yet, that tiny amount of antibodies in the blood was sufficient to offer demonstrable even if not complete protection against the paralytic disease for about 4 weeks after which the injected antibodies began to disappear.

Under grants from the national foundation several laboratories are busily engaged in the preparation of possible polio vaccines. Typical of these is the laboratory at the University of Pittsburgh under the direction of Jonas E. Salk, M. D., who was also prominent in the task of identifying the virus types.

Here, as was indicated by his article published in the March 28, 1953 issue of the Journal of the American Medical Association, virus of all three types is being grown in thousands of sealed test tubes nested in slotted drums that revolved slowly in warming ovens. When ready for harvesting, the virus is removed, suspended in a salt solution, and exposed for a time to formalin. This chemical "inactivates" the virus—that is, makes it incapable of causing disease.

After a series of rigorous tests to assure its safety, the vaccine is then ready for critical tests to determine its ability to stimulate the body to create its own protective antibodies against all three polio viruses.

In the laboratory, Dr. Salk and his associates first successfully administered such experimental vaccines to monkeys and chimpanzees, then to about 100 children and adults. The results indicated that the preparation caused no undesirable side effects and that within a short time after administration there occurred a significant increase in the

amount of protective antibodies. In a more recent report presented at the annual meeting of the American Academy of Pediatrics, Dr. Salk revealed that he had extended his studies to include more than 700 children and adults, with continued excellent results.

On the basis of these latest findings, the national foundation is now formulating definitive plans for a scientifically controlled human study to evaluate the effectiveness of the vaccine in protecting children against the naturally occurring disease. This will entail the vaccination of large numbers of children in many communities during a non-epidemic period and observing the degree and extent of protection afforded when polio epidemics next visit their communities.

The outcome of such an evaluation study will determine whether a practical vaccine to prevent polio has been developed and how soon such a vaccine can be ready for general use. It is our hope that such a study can get under way during the early months of 1954.

To supplement the discussion of vaccine, since this was prepared, there has been much publicity following Dr. Salk's presentation in Miami last Friday.

As an aside to Dr. Sabin, before this hearing convened, I think none of us believed that Dr. Salk's vaccine, if it is in fact, a vaccine, is the final answer to the control of polio. I think there are many who feel that socially if we have some means of controlling this epidemic disease, then by all odds we should push ahead with its investigation. Whether the final answer to the control of polio is an inactivated virus vaccine, or a live vaccine, I think will be solved in the years to come.

In the meantime, if this inactivated virus vaccine can produce protection that will persist for a year, then I think socially, if it is without harm to the individual, we should consider its use.

When one considers a study such as is presently being contemplated, if we can do no more than demonstrate that artifically produced antibodies will protect against the natural infection in man, then I think that a fact has been established of great scientific importance. Establishing that fact and determining how much protection an individual must have to prevent the natural occurrence of the disease, then we have a baseline, and any vaccine that may be developed this year, or within the next 20 years only has to be capable of producing a higher degree of protection; that is, more antibodies persisting over a longer period of time.

Dr. SABIN. Dr. Van Riper has touched upon many of the questions that appear late in the agenda, and some of them will be enlarged to bring them perhaps to greater focus.

With your permission, at this point I would like to call on Dr. Andrews to present the gist of the prepared statement of the United States Public Health Service.

The CHAIRMAN. Before we hear Dr. Andrews I want to commend Dr. Van Riper for his very full and illuminating statement that he has presented to us this morning containing so much information. It is rather hard to digest it quickly.

What has been said, however, is an indication of the extent to which research is going on. It also gives promise of what the future may bring to us. In that respect it is a highly encouraging statement that Dr. Van Riper has given to us this morning.

Of course, we must all recognize that the National Foundation for Infantile Paralysis through the years has done a marvelous work.

It is shown by the fact that the public generally have confidence in it if we are to judge by their willingness to contribute to it as they have.

I can only feel a sense of very great satisfaction to realize that so much progress has been made. While it is true that it has not reached the definite results that we all have as our objective, yet it is tending toward it, so the groping that has taken place over a period of years in producing results, as it has, lays a broader and deeper foundation for the work that is to be carried out in the future, so for that reason I hope I am not too optimistic in assuming that we will move more rapidly in the years ahead than we have in the years past, due entirely to the fact we have the results of the labors that have been carried on in the past as now the starting point for the future.

I assume that sometime during the morning some reference may be given additional to what Dr. Van Riper has already stated with reference to this polio vaccine that is referred to as a result of work done by Dr. Salk. It has received a great deal of publicity and naturally it has created a great deal of interest for that very reason. I do not take it, necessarily, that the amount of publicity that has been given to a proposed remedy is always indicative of the value of the remedy, but in view of the fact that polio is something that touches very one of us because of the possibility of its coming to those who are close to us, it naturally creates a lot of interest when someone suggests anything that may prove helpful in the control or the cure of the disease.

So with this wide publicity that has been given to Dr. Salk's ability as a polio researcher, I would be glad if anyone feels free to do so at some time during our discussion to indicate just what the possibilities are.

In some respects I have noticed that Dr. Salk has been a bit modest and reserved and that he is not claiming too much, and yet even to claim a little gives much encouragement to laymen who have a natural interest in the problem and it calls for some discussion, if it is possible for us to have it.

Mr. THORNBERRY. Dr. Van Riper, in the discussion of the vaccine about which you have been talking, I take it there is a distinction between the vaccine Dr. Salk discusses and gamma globulin; is that right?

Dr. VAN RIPER. That is right. The gamma globulin is the transference of immunity from one who has acquired it by the natural means of inflection to the individual we think to be susceptible. That is the work that Dr. Hammon demonstrated in 1951 and 1952 in Houston and Sioux City. We have known for years that you could protect a susceptible child from an attack of clinical measles by giving this gamma globulin. The vaccine, on the other hand, is given to stimulate the body to produce its own antibodies which are longer lasting.

Now, Dr. Salk has demonstrated that the vaccinated individual would apparently have sufficient antibodies to protect him for at least a year. That is as long as these first children that he had vaccinated have been followed, and time alone can tell how soon, or over what period of time, these antibodies, which have been artificially stimulated through vaccination, will persist. That is why I mentioned that all of us who have any interest in this field would hope eventually, or

would believe, that probably a vaccine prepared from virus still alive but incapable of causing clinical diseases would produce immunity over a longer period of time and of a higher degree.

Mr. THORNBERRY. As I understand it, these tests that have been conducted in the past, about which there has been a great deal of discussion and of which we have read, were injections of gamma globulin?

Dr. VAN RIPER. That is right.

Mr. THORNBERRY. With regard to the paper that was read last Friday, I obtained the impression that it is planned to administer this vaccine to a large group of children in 1954. I take it that it will be sponsored by your group; is that right?

Dr. VAN RIPER. That is right. Dr. Salk to date, as this paper indicated, has vaccinated approximately 700 individuals in Allegheny County.

Now, the crucial question is, Is this artificially produced protection sufficient to protect individuals against the naturally acquired disease in the future? The only way that question will ever be answered is to vaccinate a sufficiently large number of individuals and then simply wait until an epidemic hits in a community where the vaccination program has taken place to determine whether or not they are protected. We recognize it must be a considerable number.

Now, the extent of that program, just what will be done, is being worked out. It is a tremendous program. Between now and the 1st of December, numerous meetings will be held with individuals on whom we rely for advice in this matter, including the Public Health Service and the State and Territorial health officers and men working in this whole field of polio prevention.

It has not been determined at the moment what will be done, to what extent something will be done, or where it will be done.

Mr. THORNBERRY. I understand that. As the chairman said, it is very encouraging. From my point of view, it is very encouraging that your group has sponsored so much research. At times it is a little difficult for the public to understand why so much of the contribution is necessary for research; yet, on the other hand, I know that there are many who cannot afford the tremendous expense and care necessary after they have been infected by the virus.

You referred a while ago to helping those who could not afford it. Is it the experience of the foundation that very few people can really afford the tremendous cost of the cure and treatment and care of polio?

Dr. VAN RIPER. An analysis of this statement will indicate that the majority of people make some contribution. There are many cases of polio reported that are mildly paralytic; just a transient weakness. The thing that we have encouraged this year, in areas where it is at all practical, is to have home care rather than sending them to the hospitals, so that the cases are at home and need only perhaps a visiting nurse, a visiting physical therapist, or physician. Those families often care for their own. Certainly, I know very few people who could handle one of these iron-lung propositions even though they had polio insurance. Their funds will run out. I think it is difficult to establish just how many people could not have had treatment if there had been no funds from the national foundation.

As we say, there are very few people today who have polio who have not benefited from the foundation—the iron lung, the hot-pack machine, and the equipment that has been provided by the chapters. Perhaps even the physician has had a short refresher course somewhere under the foundation, so I think it is extremely difficult to say who has been neglected by the funds expended. If it had to be voluntary hospitalization that made up the deficit, or borrowing for the family, or the use of public-assistance funds, it was money that was expended, and I think we must assume that hospitalization was necessary or it could not have been ordered in the first place.

Mr. THORNBERRY. I think that is right. I did not mean to confine my question to the assistance given by the foundation. I realize that there are some mild cases of polio. The thing I was referring to was the case of severe polio where it is necessary for the patient to go into an iron lung and go through a long period of trying to get out of the lung, rehabilitation, and transfer from one hospital to another, and then finally visited by these people trained in therapy. The cost is fantastic.

I have had an opportunity to observe 2 or 3 cases—1 in particular of a young man who was a petroleum engineer and had a fair income and polio insurance. In the end neither he nor his family nor anyone else could cope with it. It was necessary to have all kinds of outside assistance.

Now, you referred a moment ago to the location of the respiratory centers. Where is the one located in Houston?

Dr. VAN RIPER. At the Jefferson Davis Hospital. That particular center has been a cooperative center supported by the foundation and the Jefferson Davis Hospital. In fact, the county or the city—I am not at the moment sure—actually operates the hospital and they actually put up a new building to house the center.

Mr. THORNBERRY. I know that.

Dr. VAN RIPER. We are subsidizing many of the personnel there and have provided much of the equipment.

Mr. THORNBERRY. There are just a few centers in existence. There are not too many of them, are there?

Dr. VAN RIPER. No. I have listed some. The one at Chicago at the University of Illinois has just been activated. I do not believe that they have admitted a patient.

The Houston center was actually the second center opened; Wellesley was opened a few weeks prior; Ann Arbor was third; Los Angeles was fourth; Buffalo was fifth.

There again, talking about personnel, one of the problems in establishing the centers has been to find trained personnel—physicians, nurses, physiotherapists, psychologists, and all the rest—that must staff such a center to get the optimum results from hospitalization in such an area; so when we open a new center we have to rob one center to open another, but that has been a stimulus to provide more training and more interest on the part of all of the medical and ancillary personnel to enter into this project. It is a very stimulating experience.

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Mr. THORNBERRY. I can appreciate that, particularly when you have one of these epidemics. Families are interested in seeing the patient get as much personal care as is possible.

Dr. SABIN. Dr. Andrews will present the Public Health Service report.

STATEMENT OF DR. JUSTIN M. ANDREWS, ASSOCIATE CHIEF, BUREAU OF STATE SERVICES, PUBLIC HEALTH SERVICE, WASHINGTON, D. C.

Dr. ANDREWS. I would like very much at this point to have the entire statement inserted in the record.

The CHAIRMAN. Without objection, it will be inserted in the record at this point.

(The statement referred to is as follows:)

POLIOMYELITIS

(Prepared for Hearing of the House Committee on Interstate and Foreign Commerce by National Microbiological Institute, National Institutes of Health, and the Bureau of State Services, Public Health Service, United States Department of Health, Education, and Welfare)

GENERAL CONSIDERATIONS

Poliomyelitis, or infantile paralysis, is an acute infectious process due to specific agents which are invisible to ordinary microscopes and small enough to be forced through the pores of a porcelain filter. These agents, or viruses, infrequently enter the central nervous system where they attack the gray matter of the spinal cord, ultimately causing a weakness or paralysis of certain muscles or muscle groups which may lead to crippling or death. Far more frequently, however, the viruses multiply within the lower intestinal tract, producing a mild or benign infection unaccompanied by signs of central nervous system disturbance. The disease was first produced in monkeys experimentally and its causative agent identified as a virus in 1909. Shortly thereafter the virus was demonstrated in the stools and nasopharyngeal secretions of persons sick with the disease and of many other individuals who had been in contact with them.

In 1910 the Surgeon General of the Public Health Service requested all States to submit reports on the occurrence of poliomyelitis for 1909 and 1910. This initiated the national reporting of the disease, though all States did not participate until 1922.

Poliomyelitis is ubiquitous in this country, is primarily an infection of childhood, and frequently occurs in epidemic proportions on national, regional, or local scales. The most severe of these outbreaks occurred in 1916. Since 1938 the trend of annual morbidity has been increasing so that in 1952 over 57,000 cases were reported. Death rates have also risen slightly, but the ratio of cases to deaths has increased doubtless due to (1) More adequate recognition and reporting of mild cases and (2) better medical care of the severely ill. Details of reported morbidity and mortality, and of geographic and seasonal distribution of cases are reviewed in the attached article entitled "Poliomyelitis Distribution in the United States," by two Public Health Service statisticians, and tabulated data supplied by the National Office of Vital Statistics.

No effort is being made in this statement to assess the economic burden of this disease upon the Nation or upon the families of the afflicted. It is believed that the National Foundation for Infantile Paralysis can deal more adequately with the socioeconomic aspects of infantile paralysis.

PAST RESEARCH ACTIVITIES

Research interests in this disease developed in this country shortly after the turn of the century. In 1910 a Public Health Service scientist reviewed existing knowledge concerning poliomyelitis, much of this being based upon Scandinavian experience in the 1905 epidemic, and recommended that studies be under-

taken by the Public Health Service. In the years that followed, these investigations were directed largely at studying the occurrence of the disease in nature. This period was by no means unproductive despite the fact that most of the major advances in our knowledge of poliomyelitis go back little more than 15 years.

For example, it was deduced by Public Health Service scientists from field investigations that although only a small proportion of any population actually develops frank symptoms of infantile paralysis, many more persons must have been silently infected and immunized as a result. Therefore, most adults should have protective antibodies, that is, substances formed after and as a result of infection and capable of neutralizing virus, in their blood. This logic produced the concept of paralytic against abortive or asymptomatic poliomyelitis, now recognized to be of great scientific and administrative importance. It also led to the first demonstration of blood-borne antibodies against the disease.

Field evidence suggested that paralyzed domestic animals might play a reservoir role in the transmission of poliomyelitis. Careful observation of such beasts associated with man and testing them for virus proved the hypothesis to be untenable.

The most extensive of the early field studies by the Public Health Service was an investigation in 1916 of the great outbreak concentrated in New England and New York. The report of this investigation remains a classic in the epidemiologic literature of this disease. Through the succeeding years the central conclusion of this study—that poliomyelitis is spread by person-to-person contact infection—has stood up though many other assumptions concerning the modes of transmission have been tested and discarded.

As in other fields of research, many blind alleys were encountered over these years and much effort expended on work which produced only negative results. Failures must be documented and analyzed before the critical investigator can profitably test new approaches and fresh clues. Poliomyelitis infection was presumed at that time to be acquired as the result of inhaling airborne particles of virus which impinged upon and entered nerve endings in the nasal mucosa. Thence they proceeded along nerve pathways to the central nervous system. Public Health Service scientists undertook experimentally to prevent infection by spraying tissue coagulating materials intranasally, but field observations demonstrated that this painful and dangerous procedure was impractical for human use.

By the end of World War II it was known that the viruses of poliomyelitis could be readily found in sewage and flies during epidemics, observations which were given wide newspaper publicity in the early and midforties. Coupled with the dramatic insecticidal success experienced during and immediately after the war, with DDT, these findings led the public to assume that poliomyelitis was spread by flies and that it could be prevented by the new fly-control techniques. State and local health officers were urged to apply these methods on a large scale when epidemics occurred, and these officials turned to the Public Health Service for advice and guidance in the matter.

No reliable information as to the transmission significance of virus in flies and sewage was available. Limited field tests were made during 1945 in Rockford, Ill., and Paterson, N. J., to determine whether or not epidemics might be aborted by community fly control. These were undertaken as a project of the Commission on Neurotropic Virus Diseases of the United States Army Epidemiological Board, aided by a grant from the National Foundation for Infantile Paralysis and with personnel and equipment supplied by the Public Health Service. The results obtained were regarded as inconclusive. Thus at the continued behest of harassed health officers who needed to know whether or not they were justified in spending public moneys for fly control during outbreaks of infantile paralysis, new field research was instituted by the Public Health Service.

In 1946, a laboratory for the diagnosis of virus diseases was established at Montgomery, Ala., together with a mobile insect-control unit equipped to supply insecticides by airplane, power sprayers on trucks, and by hand, and to effect other insect control measures on an emergency basis. Staff included medical, entomologic, and engineering specialists. The ultimate objectives of this project were to improve and expedite insect-control technology and to investigate and control neurotropic virus infections, including poliomyelitis, known or suspected to be insect-borne. It was believed that the rapid accomplishment of fly control as early as possible during epidemics of poliomyelitis would demonstrate the significance of flies in its transmission, and whether or not community fly control was justified as an antipoliomyelitis measure.

This unit operated in several cities. In each instance, fly control was rapidly effected but it gradually became evident that it was well-nigh impossible to rush a prepared insect-control unit to the scene of an outbreak early enough in the course of a genuine epidemic of poliomyelitis to have any obvious effect upon the community pattern of infection. This led to the conviction that it was not practicable to try to terminate poliomyelitis epidemics by emergency fly-control operations because of (1) the uncertainty of identifying these outbreaks in their early phases and in predicting their extent, and (2) the magnitude of the physical operation of achieving effective and wide spread fly control by unprepared health agencies within a short period of time.

The following year, 1948, a poliomyelitis epidemic of extended proportions occurred in Hidalgo County, Tex., where controlled observations of the effect of fly reduction on the spread of diarrhea were being carried on jointly by the National Microbiological Institute and the Bureau of State Services. Thus it was possible to study the progress of poliomyelitis infection in neighboring communities, in some of which high-grade fly control had been achieved months before the advent of poliomyelitis, and in others where flies were abundant. The National Foundation for Infantile Paralysis assisted in the laboratory phases of this study. The analysis of the field observations were not completed until some time thereafter but the findings turned out to be very significant and will be referred to later.

Because of the apparent failure of emergency fly control to abate epidemic poliomyelitis, it was decided to test the effect of continuous, year-round fly control in preventing epidemics of infantile paralysis. This proposal had the endorsement of the consultants of the National Foundation for Infantile Paralysis. Thus the approach in 1949 was to compare and observe the poliomyelitis experience in five cities where high-grade fly control was being maintained, with the incidence in another group of comparable cities lacking fly control. It was believed that the collection of data necessary to answer this question would contribute also to various other aspects of the epidemiology of poliomyelitis; to knowledge of the taxonomy, behavior, and ecology of flies; and to the improvement of community fly-control techniques.

One of the grantees of the National Foundation for Infantile Paralysis, the Yale poliomyelitis study unit, was interested in ascertaining where the virus existed in nature while it was not being obviously transmitted. Hundreds of collections of flies and sewage were made, frozen, and held until it was apparent that poliomyelitis was not being actively spread in that area during the ensuing summer. When transmission did occur, these specimens were sent to New Haven for the isolation of poliomyelitis and other viruses which might be insect or sewage-borne. Thus the agent of Coxsackie infection which is similar in many respects to that of poliomyelitis, was found in flies and sewage during the summer months while poliomyelitis was occurring in the population, but not in the winter after new cases ceased. The more costly isolations of poliomyelitis virus are still to be done.

This program while theoretically sound was not economically feasible within the limitation of appropriated funds. The engineering and entomologic phases of investigation were rapidly and satisfactorily developed but it became increasingly manifest that a mere counting and clinical verification of reported cases of poliomyelitis would be wholly inadequate for making an effective epidemiologic evaluation. More refined and intensive studies were needed particularly on clusters of families comprising small groups homogeneous with respect to sanitary environment, socioeconomic level, ethnic category, etc. The more specific findings from such studies could then be related to pertinent environmental variables, including fly densities. It was also recognized that such studies would provide basic field observations of a broader interest than the role of flies alone regarding the transmission of poliomyelitis. Field observations have been concentrated, therefore, since 1950 in 2 of the 5 cities where fly-control operations and investigations had been in progress since 1948. These are Charleston, W. Va., where the disease is typically seasonal, and Phoenix, Ariz., where it occurs throughout the year.

The Yale poliomyelitis study unit collaborated in the planning of these arrangements and has undertaken major responsibility for making the laboratory isolations of virus and of performing other laboratory examinations to indicate previous infection. This has permitted the measurement of the incidence of poliomyelitis, abortive and inapparent as well as clinical infection, with a precision which was not previously possible. The present activities and accomplishments are reviewed below under "Present activities."

DIAGNOSTIC TECHNOLOGY

During the early years, relatively little was accomplished in the laboratory primarily because of the lack of cheap, simple, and effective methods of isolating, identifying, and maintaining poliomyelitis virus. No test-tube techniques existed and monkeys were the only animals known to be experimentally susceptible. They are difficult to handle and are so expensive to purchase and sustain in the laboratory that their use in the large numbers required to validate experimental findings was prohibitively costly.

This situation was relieved to a substantial degree in 1939 when a Public Health Service scientist in the National Institutes of Health succeeded in growing a strain (Lansing) of poliomyelitis virus in cotton rats and mice.

This constituted a major advance in diagnostic technology and greatly expanded the possibilities of acquiring new knowledge.

From 1948 to 1951, due in large measure to assistance by the National Foundation for Infantile Paralysis, researchers in this field ascertained that poliomyelitis is caused by any 1 of 3 related but separately identifiable viruses rather than by a single agent. Infection with 1 of these types protects against reinfection with the same type, but not against infection with either of the other 2. This is very significant knowledge. It provides rationalization for certain earlier observations which appeared to be contradictory or difficult to confirm, and is crucial to a more adequate approach to the problems of laboratory diagnosis, pathogenesis, epidemiology, and prevention of the disease. With this information, it became desirable to find laboratory test animals susceptible to the other strains of poliomyelitis virus. A second type (Leon) was adapted to mice in 1951 by National Microbiological Institute scientists using a newly developed method of inoculation. Instead of injecting virus into the brain, which was the customary procedure, the inoculation was made directly into the spinal cord of mice. This calls for very delicate and precise technique but it has resulted in adaptation not only of the Leon strain but, some 2 years later, of the third strain (Brunhilde) by Public Health Service scientists at the virus laboratory in Montgomery. The transmission of all three types of virus to small, inexpensive laboratory animals provides investigators with a cheap and effective method of identifying previous infection in man without resorting to the use of monkeys.

The isolation of poliomyelitis virus and the identification of its type has been further facilitated by Harvard investigators who have developed a tissue culture method which eliminates the use of a host test animal by growing the virus in living tissue which develops within a test tube. This procedure has been further cheapened and simplified by Public Health Service virologists with the view of making it a practical one to be used in State health laboratories.

PRESENT ACTIVITIES

At the present time the National Microbiological Institute is conducting a nationwide study to determine whether the epidemic occurrence of poliomyelitis may be caused by inherent differences in virus strain. Some 300 specimens were collected from patients in 20 areas of the United States during the summer of 1952, which was a season of unusually high poliomyelitis incidence. The sampling included both epidemic and nonepidemic areas. These specimens are being processed by tissue culture methods for isolation of the virus and its identification by type.

In other investigations, scientists at the National Microbiological Institute have been studying the mode of infection and development of the clinical disease in an effort to determine the factors which govern the appearance or absence of paralysis in human poliomyelitis. The ultimate objective is to find methods of modifying or preventing clinical paralysis in human disease. In recent years it has been shown that injections for immunization, especially with whooping-cough vaccine, preceding the onset of poliomyelitis, will increase the severity of the paralysis and localize it in the limb where the vaccine has been injected. This has been duplicated experimentally in the laboratory and evidence suggests that the mechanism of action may be through the formation of the chemical, histamine.

In another approach to this same problem, National Microbiological Institute scientists have studied changes occurring in the central nervous tissue early in the stage of recovery from paralytic disease. They have found some evidence that antiviral substances, possibly differing from antibodies, may be produced by damaged or recovering cells. Work has also been done to assess the importance and influence of antibodies in the blood and spinal fluid during the early phases of poliomyelitis infection. Work in other institutitons has suggested that the rapidity of antibody production may determine the subsequent occurrence of paralysis.

Field investigations are continuing on an expanded basis in Phoenix, Ariz., and in Charleston, W. Va. These are being made by Communicable Disease Center scientists with the laboratory work being carried on by the Yale poliomyelitis study unit. All reported and suspected cases of poliomyelitis occurring within the study cities are investigated in detail to verify diagnosis, to delete spurious cases of illness which simulate poliomyelitis, to obtain consistent counting of recognized cases, and to trace the source and spread of the disease if possible. Fly-control studies in relation to the prevention of poliomyelitis have been discontinued as the results of the Hidalgo County (Tex.) study have shown conclusively that the course of a well-established epidemic of poliomyelitis did not appear to be modified by effective fly control. On the other hand, it was clearly shown that the spread of cases in this area was related to contact with cases.

In the course of the Phoenix-Charleston study it is possible to follow the development, persistence, and concentration of neutralizing antibodies to each of the three poliomyelitis virus types and of complement-fixing antibodies against type II (Lansing) virus. It is also possible to relate the effect of sanitary environment, socioeconomic status, family size, contact with other cases, etc., on the acquisition of poliomyelitis antibodies as well as on the incidence of clinical cases. The history of minor, unreported illness in households as determined by monthly morbidity surveys is correlated with antibody development. In a limited series, it is possible to determine whether the development of antibody can be correlated with previous excretion of virus of the same type, and whether the acquisition of a second type of antibody has any effect upon the concentration of an antibody previously present. Several hundred blood specimens have been obtained from residents, especially children, in study areas of both Charleston and Phoenix during the spring and in the fall of 1951, 1952, and 1953. Some of these are paired specimens from the same individual for 3 years. This is a very valuable collection of material. It is being studied to determine the presence and concentration of poliomyelitis antibodies and it is by this means that it is possible to determine the age at which these substances are acquired, the concentration achieved, and the length of time that they remain in evidence. It has already been shown in both of these cities as elsewhere that children in the lower socioeconomic group acquire antibodies much faster than those in the more favorable group. Fifty percent of the 1- to 2-year olds in the lower group already had acquired antibodies; this much immunity was not reached in the more privileged class until the age 7 to 8. The findings also suggest that the prevalence of this particular type poliomyelitis antibody is related to the size of family and that older children, at least among the more privileged citizens, represent an important source of introduction of infection into the household.

A small outbreak of sore throat and fever, assumed to be abortive poliomyelitis, was investigated in a block of Charleston because of its history of contact with a case of infantile paralysis. However, the virus isolation showed the disease to be herpangina, an infection associated with type II Coxsackie virus. This illustrates the need for better definition of minor illnesses relative to abortive poliomyelitis. Much more material has been collected in the field than can be analyzed in the laboratory for months to come. Several papers have already been published but many more will be forthcoming.

In Montgomery, the Communicable Disease Center virologists have shown that the strain of Brunhilde virus which was adapted to the mouse by intraspinal inoculation has shown certain unusual properties. It appears to have lost much if not all of its capacity to produce paralysis in monkeys. At the same time it is still capable of immunizing these animals against subsequent infection with the same strain of poliomyelitis virus. If these characteristics remain genetically stable, it is conceivable that this strain of virus might become the basis of a vaccine against this type of poliomyelitis which appears to be the most prevalent one in epidemics of paralytic poliomyelitis. This would employ a principle commonly used in the biological prevention of such viral diseases as yellow fever, foot-and-mouth disease, hog cholera, and others, namely, protection by deliberate infection with a strain of the causative agent which has lost its capacity to produce disease without losing its ability to immunize. Further extensive and expensive tests in the laboratory must be made to determine whether or not any effort should be made to explore these potential vaccine developments further.

RECENT EXPENDITURES

The figures which appear in the table on the next page indicate how much of the budget of the Communicable Disease Center and of the National Microbiological Institute has been devoted to poliomyelitis activities in the last 4 years.

In reference to the latter, these allocations do not include the cost of control work in connection with carrying out the provisions of the biologics law. It should also be borne in mind that the National Microbiological Institute is not a categorical institute dealing with only one field of disease. Its activities cover a wide range of infection and parasitic disease.

No research on poliomyelitis as such is supported by the National Microbiological Institute under its research-grants program. The institute does, however, support a number of studies in universities and other research institutions in the broad field of virus diseases. Fundamental knowledge derived from these studies will be applicable to many problems in infectious diseases, including poliomyelitis.

FUTURE NEEDS

There are three areas of research which from the standpoint of the control and the prevention of poliomyelitis may be considered to be of preeminent importance. The first of these is the development of a specific vaccine and the appraisal of its prophylactic potentialities against this disease. In an infection which appears to be transmitted to susceptible individuals primarily by contact with infected persons, and in which a solid substantial immunity results from infection, all considerations point to the desirability of protection by creating immunity with a vaccine. Pending the development of such biologic preventive, the passive transfer of protective antibodies by means of gamma globulin will serve to prevent or modify the severity in many cases. It is evident, however, that a good vaccine which will stimulate its recipient to generate his own antibodies the rest of his life would be more effective and cheaper. Much progress is being made in the development of such a material, but it must be remembered that the first such experimental product is not necessarily the most effective, the safest, or the least costly. Research to discover better vaccines should go on as an important element of a planned program of research on poliomyelitis.

The second great need in the control of this disease is a chemotherapeutic agent which will cure the infection promptly, alleviate its acute symptoms, and prevent the crippling or lethal paralysis which might otherwise ensue. Much work has been done in this area with no significant success thus far. Unlike the search for the best vaccine, which should be the goal of an orderly, planned progression of studies and experiments, it seems as likely that the specific medication against poliomyelitis may be found as the result of research entirely unrelated to infantile paralysis. That has been the situation with respect to certain other diseases. A decade ago, for example, a new and highly successful drug, chloroquine, was developed to combat malaria. Today this drug is finding clinical application in studies of rheumatoid arthritis and certain skin diseases. The same is true of another antimalarial preparation, developed since the Korean conflict, which has proved promising in studies of leukemia and toxoplasmosis in experimental animals.

The third area of essential knowledge in which more work should be in progress is the specific pathogenesis of paralytic poliomyelitis. It is now known that, in the early stages of poliomyelitis, the virus circulates in the blood. What is the incident or accident or circumstance within or external to the body of such an individual which, one time in a hundred or more, permits the virus to enter and damage the central nervous system causing paralysis? Ancillary to this consideration is the determination of whether or not this rare circumstance is controllable or preventable. If so, another means of protection against paralysis might become available; if not, we would realize that we must put our reliance entirely on vaccines.

With respect to the vaccines now undergoing development and evaluation by various nongovernmental groups sponsored largely by voluntary foundations, it would probably be safe to say that the final outcome of this effort would not be influenced substantially by Federal appropriations to augment work under way. The same is probably true of chemotherapeutic research, for it is more than likely that every new antibiotic or new drug which is significantly successful in combating any infectious disease is promptly tested against poliomyelitis. Thus it would seem that congressional support might wisely be directed to broad noncategorical research of a fundamental nature—the acquisition of knowledge which has profound implications in many disease areas.

One such area, for example, is upper-respiratory infections, of which the common cold is a conspicuous example. Here is a disease problem which has long and stubbornly resisted solution. The economic burden that the common cold imposes on our people is great enough in itself to justify a much stronger research effort than is now being supported. The same is true of a number of

other diseases caused by viruses, rickettsiae, and fungi. For investigators, these problems all have a common denominator: a paucity of fundamental knowledge. Before we can develop preventive measures against such ailments, or better methods of treatment, we need to know more about the life processes of disease organisms—their metabolism, their genetic constitution, and many other factors concerning their structure and behavior, and host-parasite relations.

The specific benefits to be derived from a broad approach to research problems are impossible to predict. From past experience, however, we know that new knowledge frequently finds unexpected application to problems far removed from the original area of investigation. The point which is worth emphasizing here is that the basic knowledge which we seek in critical research is essentially noncategorical. In our efforts to find answers to pressing problems, we must remember that imaginative science seldom reaches its full potentialities when support is inflexible and work is restricted to rigidly specified problems. The record of history shows that tomorrow's practical results are almost always the progeny of today's free curiosity.

Appropriated funds to Public Health Service used for poliomyelitis—Research and diagnosis

Fiscal year	National Microbiological Institute (National Institutes of Health)		Communicable Disease Center (Bureau of State Services)		
	Total for direct operations	Amount for polio research	Total for all activities	Poliomyelitis	
				Field research	Laboratory research and diagnosis
1950	$2,361,000	$22,000	$7,350,000	$248,270	$20,000
1951	2,376,000	82,000	6,165,000	260,240	25,000
1952	2,479,000	72,000	5,915,747	294,650	25,000
1953	3,386,000	72,000	5,919,750	201,909	30,000

Poliomyelitis Distribution in the United States

By Robert E. Serfling, Ph. D., and Ida L. Sherman, M. S.

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In the early summer of 1894 inhabitants of the Otter Creek Valley in western Vermont became aware of a strange paralytic disease in their community. It seemed to select younger children as particular victims although a few adults were also affected. This first notable epidemic of poliomyelitis in the United States was carefully investigated by Dr. C. S. Caverly, president, Vermont State Board of Health. His field studies, constituting a classic model of "shoe-leather" epidemiology, mark the beginning of our modern knowledge of poliomyelitis. In the following years other investigations conducted in the Caverly pattern demonstrated the extensive distribution of the disease and indicated the need for systematic morbidity reporting.

Massachusetts, in 1907, was the first State (1) to require notification of all cases of poliomyelitis. In 1910, the Surgeon General of the Public Health Service requested all States to submit reports on poliomyelitis for 1909 and 1910. This initiated national reporting of poliomyelitis, although regular inclusion of reports from all States was not achieved until about 1922. Since that time a large body of data has accumulated, forming an increasingly comprehensive base for continuing analyses of elementary epidemiological characteristics, such as secular trends, geographic distribution, and seasonal variations. A number of excellent analyses have been published (2, 3, 4, 5), but the most recent include only the years through 1946 in the United States (6, 7). Sabin (8) reviewed epidemiological characteristics of a number of poliomyelitis outbreaks throughout the world.

Certain epidemiological characteristics of poliomyelitis have changed with time. In the United States, annual rates both of reported cases and of deaths have shown an upward trend, particularly during the past decade. In earlier

decades a lower incidence was observed in Southern States that in Northern States. This difference is less apparent in recent year.

Continuing studies and analysis of these elementary epidemiological characteristics and their changes are indicated for any infectious disease that remains as a serious problem in the country. Furthermore, discovery of the value of gamma globulin in the prophylaxis of poliomyelitis (9, 10) poses difficult problems as to the best way to utilize available supplies.

The fullest possible knowledge of the current epidemiological pattern of poliomyelitis as revealed by morbidity and mortality reports may be useful in guiding administrative decisions. For these reasons the present paper has been prepared. The past history of poliomyelitis as recorded in published literature and official reports was reviewed and special attention was given the period 1932 to 1952 with particular emphasis on changing patterns of the past 5 to 10 years.

NATIONAL INCIDENCE

The trend of the national case and death rates in the United States during the period 1910–52, is shown in figure 1. Since both cases and deaths were not reported from the same group of States during earlier years, the rates in figure 1 were based on reports from those States which reported both cases and deaths. The record of national incidence of poliomyelitis in the United States falls naturally into four periods:

1. Prior to 1909, when information on incidence, except for a few States, depended on descriptive accounts in the epidemiological literature.
2. From 1909–16, when published reports were available from some States. These were supplemented by special studies of Lavinder, Freeman, and Frost, and their summaries give more complete information on the period.
3. From 1917 through the epidemic year 1931, during which time reporting gradually became more complete. By the middle 1920's most States were reporting annually.
4. From 1932 until the present, during which time national reporting of both cases and deaths has been essentially complete. Because of the obvious differences which characterize national reporting in the different periods, they are presented separately in this discussion.

Early years

During the 1894 outbreak in Vermont, Caverly collected information on 132 cases. Of these, 119 had shown paralysis, 7 had died before paralysis was noted, and 6, although exhibiting symptoms characteristic of early stages of the illness, had not developed paralysis. In Rutland, the largest community in the affected area, 55 of the 12,000 inhabitants had been stricken—an attack rate of 460 cases per 100,000 population. In nearby Proctor, a town of 2,000 persons, 27 cases had occurred. The remaining 50 cases were scattered through a dozen small communities in the area.

Two years later, in a final report of his investigations (11), Caverly concluded that the disease was epidemic poliomyelitis, possibly a variant form of the infantile paralysis which in the United States had been known principally as an endemic disease of relatively infrequent occurrence.

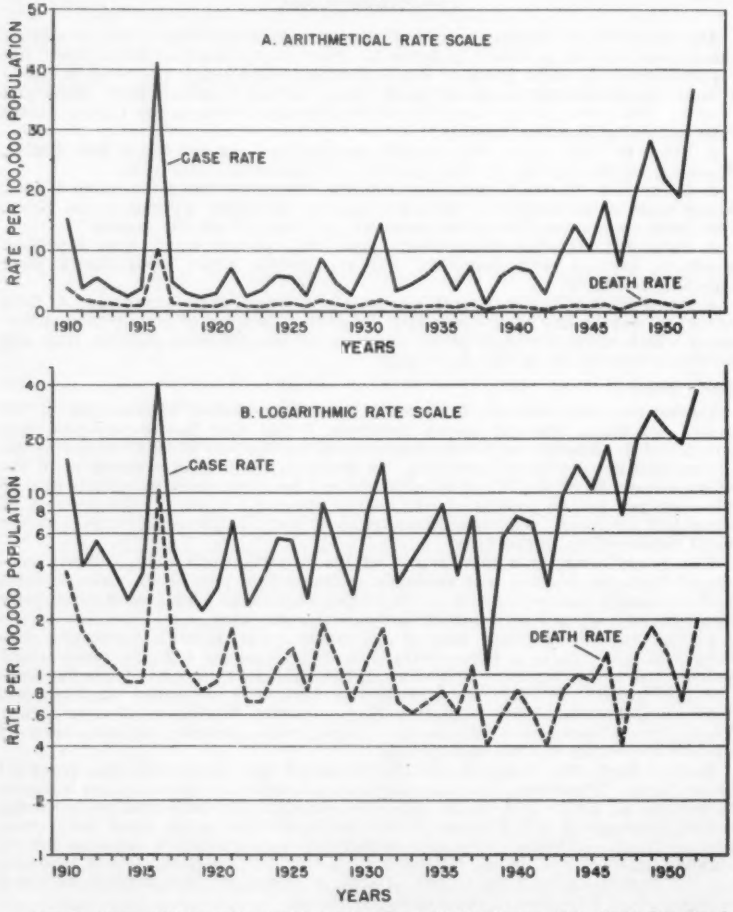
In the succeeding years similar outbreaks occurred with increasing frequency in many parts of the country. In 1908, 2 papers (12, 13) summarized accounts of 17 poliomyelitis epidemics in the United States and others throughout the world. By this time, outbreaks had been described in Alabama, California, Florida, Illinois, Maine, Massachusetts, Michigan, Missouri, New York, Pennsylvania, and Wisconsin. These seem generally to have been of smaller scale than the Rutland episode.

In New York City, however, the 1907 outbreak was the largest then recorded in any place. The impact led to an extensive retrospective investigation initiated in October of 1907. The study (14) was conducted by mail and produced detained information on 752 cases. It was estimated that in all, about 2,500 cases had occurred. Although cases were somewhat concentrated on the east side of Manhattan, the epidemic had extended northward to Poughkeepsie and throughout the western end of Long Island. The case fatality was estimated to be 5 to 7 percent, about half that of the Rutland outbreak.

In Massachusetts, where smaller outbreaks had been noticed since 1893, incidence was also high in 1907 and the State made poliomyelitis a reportable disease. In 1908, 130 cases were reported in Massachusetts (1). In midwestern Minnesota, 150 cases were recorded, and in Wisconsin, 408. In the following year, 1909, a great outbreak struck in Nebraska. Description of this epidemic (15) was also based on a retrospective study. In answers to letters,

58 physicians reported 999 cases in 18 counties. The greatest number of cases, 384, was reported from Polk County, with a population of 10,000. Douglas County (1910 population, 168,546) reported 79 cases, a rate slightly less than 50 per 100,000 population, and comparable to that of the New York City epidemic of 1907. In 1910 Massachusetts reported 845 cases, Pennsylvania 1,112, and in the Midwest, Minnesota and Iowa each recorded more than 600 cases. In the Far West, nearly 400 cases occurred in the State of Washington. On August 9 of that year (1910) the Surgeon General of the Public Health Service initiated the request that started national reporting of poliomyelitis. In the same year provision was also made for separate classification of poliomyelitis deaths in the national vital statistics summary.

Figure 1. Annual poliomyelitis case and death rates in States reporting both cases and deaths, United States, 1910–52.



Sources: Cases, 1910–50—Public Health Service: The Notifiable Diseases (Pub. Health Rep. Supp.). 1951—National Office of Vital Statistics: Reported Incidence of Notifiable Diseases in the United States, 1951, Annual Supplement to Weekly Morbidity Report, vol. 2, No. 53, 1953. 1952—National Office of Vital Statistics: Morbidity and Mortality Weekly Report, vol. 1, Nos. 1–53 inclusive. Deaths, 1910–49, Vital Statistics of the United States. U. S. Bureau of the Census, 1910–44; U. S. Public Health Service 1945–49. 1950–51 data from advance releases, 1952 data from 10 percent mortality sample, Jan.–Nov., National Office of Vital Statistics.

Years 1909–16

For 1909 only 3 States submitted morbidity reports to the Public Health Service and in the following 7 years the numbers ranged from 11 to 29. After the 1916 epidemic, Lavinder, Freeman, and Frost published a summary of morbidity and mortality for the period 1909–16 which incorporated data from a number of States not included in the earlier national summaries. For the years 1909–15 they obtained additional State morbidity reports and also mortality reports for some States in which no morbidity data were available. For the latter, estimates of cases were made from reported poliomyelitis deaths, assuming a case fatality rate of 20 percent. For States in which only certain cities were in the registration area deaths for the entire State were estimated from those in the registration areas. Since Lavinder, Freeman, and Frost had noted that in States for which registration was complete the urban death rate was lower than the rural rate and that a case fatality as high as 20 percent occurred only rarely, they believed that error in their estimates had been in the direction of underestimation. Because of the care which went into this study, their figures for annual incidence of poliomyelitis in the Nation for 1909–16 are quoted below:

Year:	*Cases per 100,000 population*
1909	6.9
1910	13.3
1911	9.5
1912	8.5
1913	6.6
1914	5.1
1915	5.1
1916	28.5

During the 5 years following the 1910 outbreaks, the estimated national rates declined. In these years the largest outbreaks took place in 1912, when New York reported 1,108 cases and California 531. These were the only instances in which a State reported more than 500 cases, although Massachusetts, New York, Pennsylvania, and Virginia reported from 100 to 500 cases annually, and Illinois and Ohio reported from 100 to 500 cases in 4 of the 5 years.

The great epidemic of 1916, although leading to highest rates in the Northeastern States, also struck severely in the north central area and in Montana. States with rates of approximately 20 per 100,000 population or larger are listed in table 1.

TABLE 1.—*States reporting 20 or more poliomyelitis cases per 100,000 population in 1916*

	Number of cases	Case rate		Number of cases	Case rate
EASTERN			CENTRAL AND WESTERN		
New Jersey	4,055	138	Minnesota	909	40
New York	13,223	129	Michigan	616	20
Connecticut	951	76	Montana	94	20
Massachusetts	1,926	52	Wisconsin	475	19
Rhode Island	222	36			
Delaware	79	37			
Pennsylvania	2,181	26			
Maryland	352	26			
Maine	149	19			

Source: Lavinder, Freeman, and Frost (1).

For the year 1916, Lavinder, Freeman, and Frost obtained morbidity reports from all but 4 States, amounting to a total of 29,061 cases. From these they estimated the national rate to have been 28.5 cases per 100,000 population. The total number of cases in the District of Columbia and the 27 States which reported to the Public Health Service was 27,363. Among these States, the average rate was 41 cases per 100,000 population.

Years 1917–31

After 1916, no additional efforts were made to obtain complete information on reported cases of poliomyelitis. Annual case rates for the Nation, computed on the basis of the populations of those States submitting reports, and death rates for the death-registration States are shown in table 2. The period

seems to have been one of generally low incidence of poliomyelitis. National rates varied from 2.0 in 1922 to 8.8 in 1927, except for the epidemic year of 1931, when the rate reached 12.8. Despite the generally low national rates, outbreaks of moderate size were reported by a number of States.

In 1917, the rate in Vermont was three times the 1916 rate. In the early and middle 1920's, the North Central and Western States of Minnesota, North Dakota, Montana, and Washington reported the highest rates in the country. In 1927 and 1928 a dozen States, ranging from Maine to California, reported from 21 to 49 cases per 100,000 population. The 1931 outbreak was largely concentrated in the New England and Middle Atlantic States, and in Michigan in the Midwest. The highest rates occurred in Connecticut (69.6) and in New York (48.2).

TABLE 2.—*Annual poliomyelitis case and death rates, United States,*[1] *1917–31*

Year	Cases per 100,000 population	Number of States reporting cases	Deaths per 100,000 population death-registration States	Year	Cases per 100,000 population	Number of States reporting cases	Deaths per 100,000 population death-registration States
1917	4.8	37	1.4	1925	5.2	48	1.5
1918	2.9	38	1.2	1926	2.2	48	.8
1919	2.2	40	.9	1927	8.8	48	1.8
1920	2.4	42	.9	1928	4.2	49	1.2
1921	6.1	47	1.8	1929	2.3	49	.7
1922	2.0	48	.8	1930	7.5	49	1.2
1923	2.9	49	.9	1931	12.8	48	1.8
1924	4.6	48	1.1				

[1] Includes District of Columbia as a separate reporting unit. States reporting cases not necessarily the same as those reporting deaths.

Sources: Cases, notifiable diseases, annual reports, Public Health Service; deaths, death-registration States, annual reports, Vital Statistics of the United States.

Years 1932–52

Annual rates for the United States during the period 1932–52 are shown in table 3. After the 1931 outbreak, the annual national rates did not exceed 10 cases per 100,000 population until 1944. In 1943 the case rate was 9.3, the highest since 1931, and in the succeeding years rose to successively higher levels, until in 1952 both the case rate (36.9) and the estimated death rate (2.0) were higher than in any year since the 1916 epidemic. With the marked upward trend in the morbidity rate, there has been a slight but definite increase in the mortality rate. This has resulted in a progressive decline in the ratio of reported deaths to cases from 14 percent in the period 1932–36 to 5.8 percent in the period 1947–51.

TABLE 3.—*Poliomyelitis case rates, death rates, and their ratios, United States, 1932–52*[1]

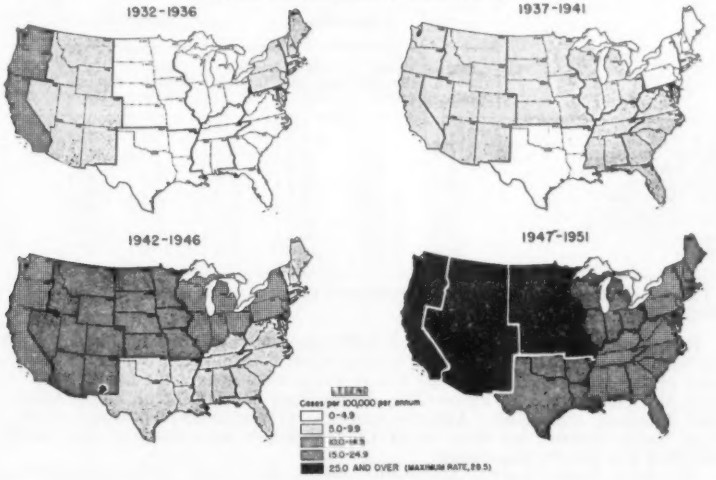
Year	Rates per 100,000 population		Ratio of death rate to case rate (percent)	Average case rate	5-year death rate	Ratio of death rate to case rate (percent)	Year	Rates per 100,000 population		Ratio of death rate to case rate (percent)	Average case rate	5-year death rate	Ratio of death rate to case rate (percent)
	Cases	Deaths						Cases	Deaths				
1932	3.0	0.7	23.3	------	------	------	1943	9.3	0.9	9.7	------	------	------
1933	4.0	.6	15.0	------	------	------	1944	14.3	1.0	7.0	------	------	------
1934	5.9	.7	11.9	------	------	------	1945	10.3	.9	8.7	------	------	------
1935	8.5	.8	9.4	------	------	------	1946	18.4	1.3	7.1	11.1	0.9	8.1
1936	3.5	.6	17.1	5.0	0.7	14.0	1947	7.5	.4	5.3	------	------	------
1937	7.4	1.1	14.9	------	------	------	1948	19.1	1.3	6.8	------	------	------
1938	1.3	.4	30.8	------	------	------	1949	28.4	1.8	6.3	------	------	------
1939	5.6	.6	10.7	------	------	------	1950	22.0	1.3	5.9	------	------	------
1940	7.4	.8	10.8	------	------	------	1951	18.6	.9	4.8	19.1	1.1	5.8
1941	6.8	.6	8.8	5.7	.7	12.3	1952	36.9	[2] 2.0	5.4	------	------	------
1942	3.0	.4	13.3	------	------	------							

[1] Case and death rates based on population of States reporting both cases and deaths.

[2] 1952 death rate estimated from 10-percent national sample of the National Office of Vital Statistics, January through November 1952.

The morbidity rate for 1952 falls between the two estimates (see above) for 1916, while the estimated mortality rate for 1952 is only one-fifth as great as the 1916 death rate of 10.5 per 100,000. The question of whether or not the 1952 epidemic was more severe than that of 1916 is obscured by several factors relating to the population bases used in determining the rates. In 1952 reports of cases and deaths were available from all States, whereas for 1916 two estimates of the morbidity rate are available, but neither of the populations on which these are based is the same as that of the 26 death-registration States for which the mortality rate was 10.5 per 100,000. Also, the 1916 population of the death-registration States coincided closely with the populations severely affected by the epidemic, while the 1952 estimated death rate of 2.0 per 100,000 includes populations not in epidemic areas. In addition to these factors, others must be considered: for example, improvement in completeness and accuracy of morbidity reporting; and improvement in treatment, presumably resulting in lowered case fatality rates.

Figure 2. Poliomyelitis morbidity—average 5-year rates, major geographic divisions of the United States, 1932–36, 1937–41, 1942–46, 1947–51.



GEOGRAPHIC DISTRIBUTION

The geographic distribution of poliomyelitis in the United States during the last 20 years is described for the 9 major geographic divisions of the country from 2 approaches: average incidence in successive 5-year periods and variation in annual incidence. Each method gives emphasis to different aspects of secular changes in geographic distribution of the disease.

Average incidence

Aycock (3), in studying distribution of poliomyelitis in the United States during the period 1910–27, and later Wells (4), in a study of the period 1915–29, came to the conclusion that incidence in the Northern States had been distinctly greater than that in the southern portion of the country. Both of these studies included the 1916 epidemic, which caused the average rates to be heavily weighted by this single northern epidemic. Collins (5), examining data for the period 1930–45 noted that little poliomyelitis had been reported from the three southern divisions prior to 1935 but that subsequently they experienced "some rather large epidemics." Gilliam, Hemphill, and Gerende (6, 7), in a study of county rates during the period 1932–46, came to a similar conclusion. In their study, the average annual rate in the period 1932–46 for northern counties was 7.6 and for southern counties, 6.4. However, in large urban counties of over 500,000 population, average rates were lower in northern than in southern counties. In counties under 100,000 population, the reverse was true—the average rates were higher in northern than in southern counties. The period

was one of generally low incidence, except for the later years, 1944–46. In the present study, examination of rates for the 20 years 1932–51, in successive 5-year periods, did not seem to reflect consistent geographic localization (fig. 2).

During the first 10 years (1932–41) of the period, average incidence was remarkably uniform over 5 of the 9 major geographic divisions (table 4) ranging from 5.1 to 5.9 per 100,000 population. One of these five was the East South Central division. The lowest rates occurred in the West South Central and South Atlantic States (3.0 and 4.6); the highest rates occurred in the Mountain and Pacific divisions (6.3 and 10.7).

During the first half (1942–46) of the next decade, the northwestern divisions had rates which were generally higher than those of the South Atlantic, East South Central, and West South Central divisions. However, within the eastern and southern regions, the average 5-year rates for the New England States was somewhat lower than that of the West South Central States.

TABLE 4.—*Average poliomyelitis case rates in each division of the United States, 1932–51, by 5-year, 10-year, and 20-year periods* [1]

Division	5-year mean				10-year mean		20-year mean
	1932 through 1936	1937 through 1941	1942 through 1946	1947 through 1951	1932 through 1941	1942 through 1951	1932 through 1951
New England	8.4	3.4	8.7	14.1	5.9	11.4	8.6
Middle Atlantic	6.0	4.2	11.6	14.5	5.1	13.1	9.1
East North Central	3.5	6.7	11.1	20.4	5.1	15.7	10.4
South Atlantic	3.8	5.3	6.4	14.0	4.6	10.2	7.4
East South Central	4.2	6.3	6.8	13.4	5.2	10.1	7.7
West South Central	1.5	4.6	9.9	22.2	3.0	16.0	9.5
West North Central	2.9	8.1	18.9	28.5	5.5	23.7	14.6
Mountain	5.5	7.1	16.6	28.5	6.3	22.5	14.4
Pacific	14.2	7.2	14.0	26.1	10.7	20.1	15.4

[1] Average numbers of cases per 100,000 population based on annual reports in Notifiable Diseases, Public Health Service.

In the next 5 years (1947–51), a different configuration was displayed, the divisions west of the Mississippi having rates considerably higher than those east of the Mississippi. Average 5-year rates were nearly the same, 13.4, 14.0, 14.1, and 14.5 per 100,000 respectively, in the East South Central, South Atlantic, New England, and Middle Atlantic States. In intermediate position were the East North Central and West South Central States with average rates of 20.4 and 22.2 per 100,000 population.

The West North Central, Mountain, and Pacific States, with average 5-year rates, respectively, of 28.5, 28.5, and 26.1, were markedly higher than the rest of the country. For individual States, 5-year average rates are shown in table 5. It should be noted that the 5-year average rates varied considerably among the States in each division.

Over the past 20 years geographic differentials in incidence between regions of the United States have existed. In the long run, these differentials have tended to become equalized, although over rather extended time periods. Over moderate periods of time, one region may experience severe epidemics alternating with periods of very low incidence, while another region may be experiencing a succession of epidemics. As a result, even longtime averages are greatly influenced by a few severe epidemic years.

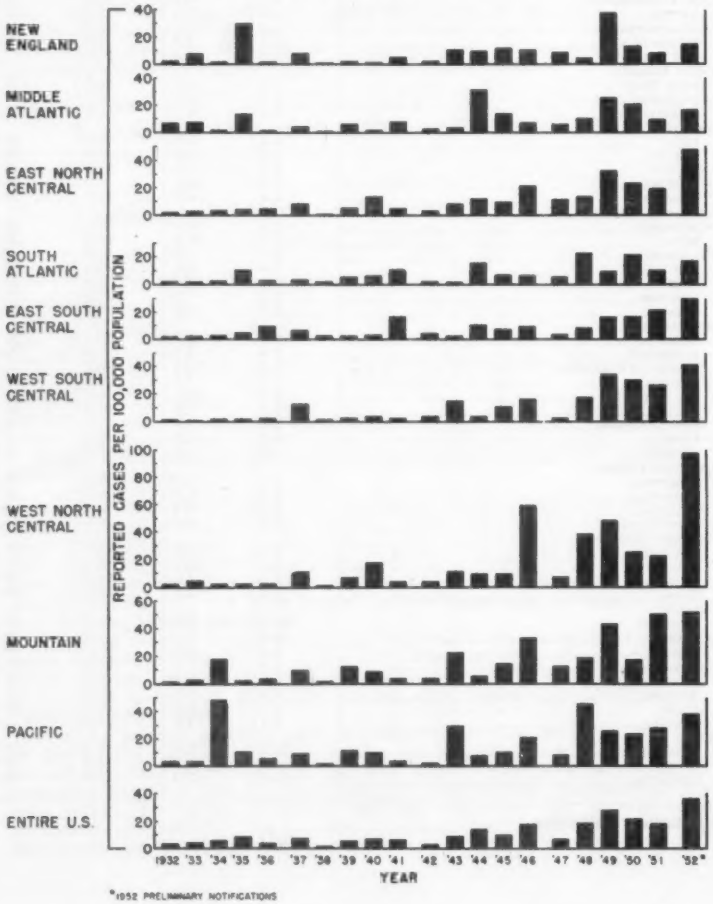
TABLE 5.—*Reported cases of poliomyelitis, per 100,000 population, by States, 1932–51* [1]

State	5-year averages			
	1932–36	1937–41	1942–46	1947–51
New England:				
Maine	8.6	5.0	4.8	14.9
New Hampshire	4.2	3.3	12.4	13.9
Vermont	9.3	6.4	13.0	15.1
Massachusetts	9.0	3.1	7.3	13.5
Rhode Island	11.3	2.4	8.2	10.6
Connecticut	6.5	3.3	10.7	17.1
Middle Atlantic:				
New York	7.7	4.7	14.6	18.5
New Jersey	5.9	4.0	9.5	16.5
Pennsylvania	4.1	3.6	5.6	8.0
East North Central:				
Ohio	3.4	5.5	7.4	18.8
Indiana	1.5	6.0	6.6	14.3
Illinois	4.0	5.2	15.3	19.4
Michigan	4.8	11.1	8.9	25.0
Wisconsin	2.4	6.7	14.7	25.6
West North Central:				
Minnesota	5.6	11.0	29.5	32.2
Iowa	2.2	11.4	11.1	34.4
Missouri	1.4	4.3	10.6	14.8
North Dakota	4.6	3.1	19.2	25.3
North Dakota	3.7	6.5	13.6	51.7
Nebraska	1.8	7.5	17.2	37.6
Kansas	3.3	9.8	23.7	26.0
South Atlantic:				
Delaware	2.2	3.4	12.4	21.9
Maryland	2.9	4.2	7.9	12.0
District of Columbia	5.5	5.0	10.7	13.9
Virginia	7.4	4.3	9.1	15.7
West Virginia	3.6	9.1	4.6	13.5
North Carolina	5.1	2.9	6.9	20.7
South Carolina	2.1	7.4	3.7	10.6
Georgia	2.2	7.1	2.9	9.7
Florida	.9	4.6	7.9	11.3
East South Central:				
Kentucky	4.7	5.5	8.6	14.0
Tennessee	5.2	5.5	6.1	14.4
Alabama	4.2	8.2	5.1	9.8
Mississippi	2.3	6.0	6.0	15.6
West South Central:				
Arkansas	1.2	5.3	7.7	21.1
Louisiana	2.2	3.5	6.5	12.7
Oklahoma	1.5	6.7	11.4	26.0
Texas	1.2	3.9	10.8	24.0
Mountain:				
Montana	13.3	6.9	10.1	12.9
Idaho	8.4	5.4	3.9	44.3
Wyoming	3.4	8.7	15.3	33.3
Colorado	1.5	7.8	23.9	32.8
New Mexico	3.3	6.9	10.8	18.0
Arizona	9.2	6.4	12.6	23.5
Utah	2.1	8.9	28.1	35.8
Nevada	5.1	1.9	9.4	16.5
Pacific:				
Washington	12.7	7.6	14.5	19.3
Oregon	4.5	5.3	14.2	20.9
California	15.9	7.4	15.5	29.5

[1] Preliminary notifications.

The average 20-year rates for western geographic divisions, which depart most from average rates of the remainder of the country, have been greatly influenced by the experience of recent years. The marked recent rise in the Western States generally, and particularly in the Southwest, suggests that it may be of interest to watch the future trend in the Southeastern States which have recently had only moderate increases in their annual rates.

Figure 3. Poliomyelitis morbidity in major geographic divisions of the United States, reported cases per 100,000 population per annum, 1932–52.



*1952 PRELIMINARY NOTIFICATIONS

Changing epidemic patterns

Interpretation of geographic differences calls for consideration not only of average incidence but also of shifting centers of epidemic concentration. Configurations of States swept by epidemics change from year to year as the areas of greatest incidence move from one region to another. Regions swept by an epidemic at one time dissolve into components which reform in new configurations as a succeeding epidemic wave develops.

The annual concentrations of epidemics have been illustrated excellently in the series of maps prepared for many years by Dr. Carl C. Dauer. The first maps in this series were published in Public Health Reports (16) and included the years 1933–37. For subsequent years the maps have been published yearly in an annual review of reported poliomyelitis in the United States. The changing centers of of epidemic concentration illustrated in detail in Dauer's series of maps can also be recognized in the annual poliomyelitis rates (fig. 3 and table 6) for each division of the United States.

TABLE 6.—*Cases of reported poliomyelitis in major geographic divisions, 1932–52*

Year	Cases per 100,000 population									
	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	United States
1932	2.3	6.7	1.9	2.3	2.0	1.8	1.1	1.4	3.5	3.0
1933	7.1	7.5	3.0	4.9	1.8	2.0	.4	2.8	3.5	4.0
1934	1.6	1.5	3.7	2.5	2.2	2.6	1.7	17.9	48.1	5.9
1935	29.3	13.2	4.1	2.2	10.2	4.9	1.8	2.2	10.5	8.5
1936	1.5	1.3	4.9	2.7	2.8	9.7	2.3	3.2	5.6	3.5
1937	8.0	4.1	8.3	11.1	3.1	6.6	12.4	9.8	9.1	7.4
1938	.9	.9	1.0	1.3	1.8	2.3	1.4	1.6	1.6	1.3
1939	1.8	6.2	5.3	7.0	5.1	2.6	2.8	12.1	11.4	5.6
1940	1.2	1.6	13.7	17.5	6.1	3.4	3.8	8.7	9.9	7.4
1941	5.2	8.0	5.0	3.8	10.4	16.5	2.4	3.5	3.9	6.8
1942	2.1	2.4	3.5	4.0	2.0	4.1	3.7	3.8	2.3	3.0
1943	10.5	3.4	8.5	11.5	1.3	2.3	14.9	22.4	29.3	9.3
1944	9.6	31.1	12.2	9.9	15.2	10.8	3.8	5.1	7.5	14.3
1945	11.3	13.9	9.8	9.8	6.9	7.1	10.7	14.0	10.1	10.3
1946	10.1	7.1	21.5	59.5	6.7	9.5	16.2	37.7	21.0	18.4
1947	8.2	6.9	11.8	7.2	5.6	3.7	2.7	12.6	8.3	7.5
1948	4.3	10.1	13.8	38.3	22.7	8.6	17.2	18.9	45.3	19.1
1949	37.1	25.4	32.8	48.9	9.5	16.5	34.3	43.3	25.8	28.4
1950	13.0	20.7	23.8	25.4	21.8	16.7	30.2	17.2	23.4	22.0
1951	7.9	9.5	19.6	22.8	10.4	21.5	26.7	50.4	27.5	18.6
1952	14.2	16.1	47.7	98.0	17.0	30.0	41.3	51.8	38.1	36.9

Source: Notifiable Diseases 1932–50 and Annual Summary in Public Health Reports, May 25, 1951, pp. 677–683. National Office of Vital Statistics: Weekly Morbidity Reports, 1952.

From 1932 through 1939, three distinctive patterns of epidemic outbreaks emerge: The Mountain and Pacific States, which experienced their most severe outbreak in 1934; the New England, Middle Atlantic, and South Atlantic States in 1935; the East South Central States in 1936 and 1937; and the remaining three central divisions in 1937.

From 1940 through 1948, severe epidemics did not strike east and west of the Mississippi in the same years, except for States in the east north central division, which experienced epidemics coincident in some years with States east of the Mississippi; in other years, with Western States. In 1944, the East North Central States reflected the eastern epidemic; and in 1946, the western outbreak.

In 1949, all divisions except the south Atlantic experienced severe outbreaks of poliomyelitis. In the latter division, 1948 and 1950 were years of greater severity. In 1950, rates were moderately high in all areas.

In 1951, the national rate was lower than in the preceding 3 years. The highest rate was recorded in the mountain division. In the severe epidemic of 1952, a record rate of 98.0 occurred in the West North Central States. Record rates were also reported from the other three central divisions and from the Mountain States. The Pacific division experienced the third highest rate in its history. Along the eastern seaboard rates were well below the national average, although moderately high in comparison with many previous years.

REPORTABLE DISEASES

TABLE 7.—*Seasonal incidence of poliomyelitis, United States, 1942–52*

[Reported cases per 100,000 population, each month, adjusted to annual base]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual rate
1942	1.0	0.9	0.7	0.5	0.7	1.1	3.4	6.9	8.7	6.8	3.3	2.2	3.0
1943	1.3	.9	.9	.7	1.2	4.2	13.0	25.5	34.6	17.2	8.0	3.2	9.3
1944	1.0	.9	.7	.8	1.2	3.8	19.6	47.8	49.5	25.5	10.8	4.0	14.3
1945	1.5	1.5	1.1	1.1	1.6	4.7	11.2	29.3	33.9	21.2	9.8	4.6	10.3
1946	1.7	1.3	1.3	1.2	2.4	8.0	25.5	65.2	52.8	34.1	14.9	6.2	18.4
1947	2.4	1.6	1.2	1.0	1.3	2.2	5.6	16.1	30.4	16.3	8.0	3.3	7.5
1948	1.4	1.0	1.0	1.1	4.4	9.2	29.5	46.6	62.9	36.6	24.1	11.5	19.1
1949	3.9	2.2	2.0	1.6	3.3	12.6	41.8	115.0	81.3	41.1	23.7	9.9	28.4
1950	3.7	3.4	2.9	2.1	4.0	9.1	24.0	54.9	66.6	49.7	31.1	11.4	22.0
1951	5.3	3.2	1.8	2.0	3.0	7.0	22.8	59.5	54.9	36.4	16.7	8.5	18.6
1952 [1]	5.0	3.0	2.1	2.8	3.7	11.9	53.0	96.0	121.7	94.0	29.5	16.9	36.9

[1] Preliminary notifications.

SEASONAL DISTRIBUTION

Figure 4. Poliomyelitis morbidity, seasonal incidence, United States, rates by month, each year, 1942–52.

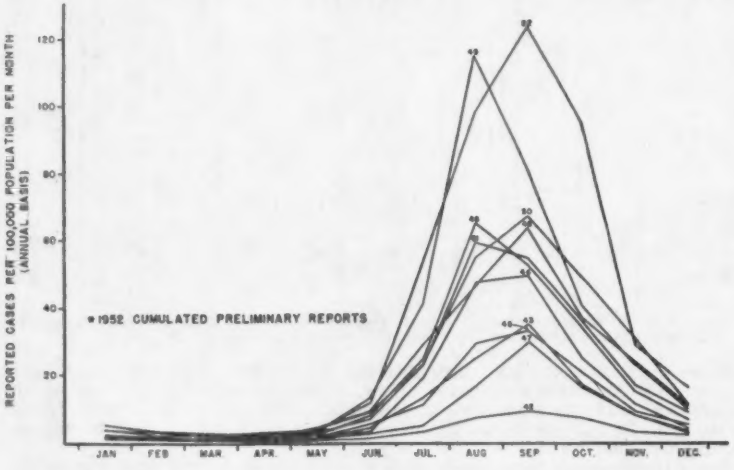
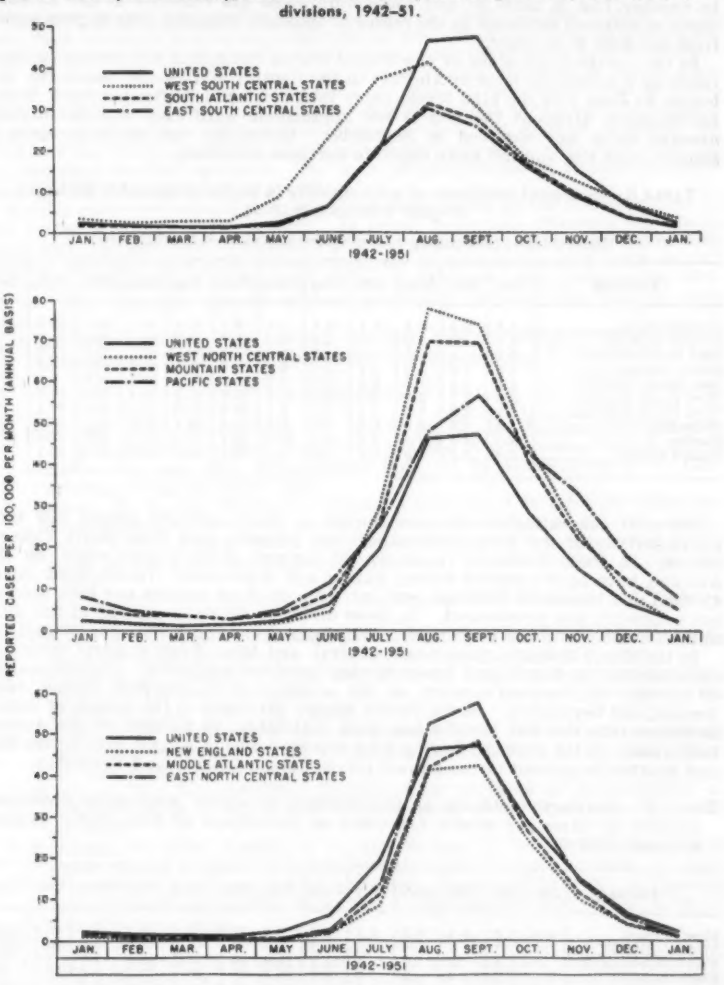


Figure 5. Poliomyelitis morbidity, seasonal incidence, 10-year average rates by major geographic divisions, 1942–51.


REPORTED CASES PER 100,000 PER MONTH (ANNUAL BASIS)
UNITED STATES
WEST SOUTH CENTRAL STATES
SOUTH ATLANTIC STATES
EAST SOUTH CENTRAL STATES
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN.
1942-1951
UNITED STATES
WEST NORTH CENTRAL STATES
MOUNTAIN STATES
PACIFIC STATES
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN.
1942-1951
UNITED STATES
NEW ENGLAND STATES
MIDDLE ATLANTIC STATES
EAST NORTH CENTRAL STATES
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN.
1942-1951

If the reported cases of poliomyelitis in the United States for each month are averaged for a few years, the resulting curve rises slightly in May, more rapidly in June and July, and reaches a maximum elevation in August and September. In October there is a marked decline which continues through succeeding months. In some years (fig. 4, table 7) August is the month of maximum incidence; in others, September; but in some the attack rate has been approximately the same in both months—for example, the years 1944 and 1951. In 2 recent years, 1950 and 1952, the October rate has been relatively higher than in earlier years.

The seasonal change in incidence differs from one region of the United States to another (fig. 5, table 8) and these differences are reflected in the national curve of seasonal incidence as the center of epidemic intensity year to year moves from one area to another.

In the southern divisions of the United States the initial rise occurs in May, reaching a maximum level in August; in the Central and Pacific States the rise begins in June and the high levels occur in August and September; and in the northeastern divisions the rise is not appreciable until July and the highest average rates are observed in September. Generally, the epidemic span is shorter, with rise and fall more rapid, in northern latitudes.

TABLE 8.—*Seasonal incidence of poliomyelitis in major geographic divisions, 10-year average, 1942–51*

[Reported cases per month, per 100,000 population adjusted to annual base]

Divisions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
New England	1.1	0.5	0.5	0.4	0.5	1.7	8.7	41.6	42.7	24.2	10.1	3.8
Middle Atlantic	1.4	.9	.7	.7	.7	1.9	11.2	42.2	48.2	26.6	11.6	4.0
East North Central	1.1	.8	.6	.5	.7	2.3	13.9	52.8	57.7	33.8	14.6	5.5
South Atlantic	1.8	1.8	1.2	1.1	2.4	6.2	20.0	31.1	27.5	16.6	9.2	3.7
East South Central	1.5	1.8	1.3	1.3	1.6	6.2	20.7	30.0	25.7	15.8	8.6	3.8
West South Central	3.5	2.5	2.9	2.8	8.4	22.6	37.2	41.1	30.4	17.8	12.3	7.0
West North Central	2.1	1.6	1.0	1.1	1.6	4.4	29.5	77.9	73.9	44.6	24.1	8.7
Mountain	5.1	3.6	3.3	2.4	3.9	8.3	25.6	69.7	69.3	40.5	22.2	12.0
Pacific	8.0	4.7	3.4	2.7	4.9	11.2	25.4	48.0	56.5	42.8	33.1	17.9
United States	2.3	1.7	1.3	1.2	2.3	6.2	19.6	46.6	47.3	28.4	15.1	6.5

Seasonal concentration of cases during a short epidemic period has been characteristic of the New England, Middle Atlantic, and East North Central States. In these divisions (table 9), 60 percent of the year's cases, on the average, have been reported during August and September. In the West North Central and Mountain divisions, concentration in these months has been similar but somewhat less pronounced. In these divisions, 50 to 55 percent of the total annual number of cases were reported during August and September in 1942–51.

In the South Atlantic, East South Central, and West South Central divisions, concentration in August and September has been less noticeable. Approximately 60 percent of the year's cases, on the average, were reported during July, August, and September. In the Pacific States, extension of the season of higher incidence into the fall months has been noticeable, 40 percent of the annual total cases, on the average, having been reported during August and September, and another 30 percent of the annual totals, during October and November.

TABLE 9.—*Seasonal incidence of poliomyelitis in major geogrpahic divisions; number of cases per month expressed as percentage of total cases, 10-year average, 1942–51*

Divisions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
New England	0.8	0.3	0.4	0.3	0.4	1.2	6.5	31.0	30.9	18.1	7.3	2.8	100.0
Middle Atlantic	.9	.6	.4	.4	.5	1.2	7.6	28.5	31.6	18.0	7.6	2.7	100.0
East North Central	.6	.4	.3	.3	.4	1.2	7.6	29.1	30.7	18.6	7.8	3.0	100.0
South Atlantic	1.4	1.4	1.0	.9	2.0	5.0	16.5	25.7	21.9	13.7	7.3	3.1	99.9
East South Central	1.3	1.4	1.1	1.1	1.4	5.1	17.7	25.7	21.3	13.5	7.1	3.3	100.0
West South Central	1.9	1.2	1.5	1.5	4.5	11.8	20.0	22.1	15.8	9.5	6.4	3.8	100.0
West North Central	.8	.5	.4	.4	.6	1.6	11.1	29.2	26.8	16.7	8.7	3.2	100.0
Mountain	1.9	1.2	1.3	.9	1.5	3.1	9.8	26.6	25.6	15.4	8.2	4.6	100.1
Pacific	3.1	1.7	1.3	1.0	1.9	4.3	10.0	18.8	21.5	16.8	12.6	7.0	100.0
United States	1.3	.9	.8	.7	1.3	3.4	11.1	26.4	26.0	16.1	8.3	3.7	100.0

SUMMARY

Early descriptive accounts of poliomyelitis outbreaks in the United States have been reviewed and an analysis made of State morbidity reports since 1907.

Poliomyelitis, a comparatively rare disease in the early years of this century, has since been recognized as a communicable disease problem in every State in the Nation. During the last 20 years the trend of the annual case rate has been upward, particularly during the last decade, during which a marked increase has occurred. The death rate has shown a slight but definite increase. In 1952, for the Nation, both the case rate and the estimated death rate were the highest since the 1916 epidemic. The ratio of reported deaths to reported cases has decreased over the last 20 years.

Earlier observers noticed that rates had been higher in the northern than in the southern regions of the country. In recent years this difference has diminished and an East-West differential is more prominent. In recent years both average and maximum rates have been higher in the western and north central divisions of the United States than in the northeastern and southeastern divisions. Over extended periods of time geographic concentration has not been consistent.

In southern regions of the country, seasonal rise in incidence occurs earlier and the epidemic span is longer than in the northern regions.

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TYPE I POLIOMYELITIS VIRUS ADAPTED TO MICE

Successful adaptation of type I (Mahoney) poliomyelitis virus to Swiss mice has been achieved by Drs. C. P. Li and Morris Schaeffer, of the Public Health Service Communicable Disease Center. Their report appears in the March 1953 issue of the Proceedings of the Society of Experimental Biology and Medicine, pages 477–481.

The authors conclude that: "The use of the intraspinal route of inoculation and the selection of a mutant or variant of the virus is believed to be responsible for this adaptation. * * * With this attainment, all three poliomyelitis virus types have now been adapted to mice. This will permit for rapid progress in field and laboratory studies of poliomyelitis." The findings are important to poliomyelitis diagnosis and to the development of a live virus vaccine.

Deaths from acute poliomyelitis: death registration States,[1] 1920–52

Year:	*Number*	Year:	*Number*
1952[2]	3,300	1935	1,040
1951[2]	1,320	1934	852
1950	1,904	1933	797
1949	2,720	1932	818
1948	1,895	1931	2,091
1947	580	1930	1,364
1946	1,845	1929	807
1945	1,186	1928	1,362
1944	1,361	1927	1,969
1943	1,151	1926	823
1942	561	1925	1,492
1941	807	1924	1,065
1940	1,026	1923	845
1939	773	1922	773
1938	487	1921	1,589
1937	1,461	1920	762
1936	780		

[1] For death registration States which increased in number from 34 States and the District of Columbia in 1920 to the entire continental United States in 1933.
[2] Estimated from a 10-percent sample of deaths.

TABLE 15.—*Reported cases of acute poliomyelitis: United States, each division and State, 1920–50*

Area	1953 [1]	1952	1951	1950	1949	1948	1947	1946	1945	1944	1943	1942	1941	1940
United States	37,500	57,879	28,386	33,300	42,033	27,726	10,827	25,698	13,624	19,029	12,450	4,167	9,086	9,804
New England				1,217	3,430	393	728	889	933	799	875	180	441	102
Maine				93	446	39	43	40	89	21	14	44	46	12
New Hampshire				38	247	24	31	188	34	68	14	12	46	3
Vermont				35	144	26	41	72	60	42	28	36	22	9
Massachusetts				518	1,782	175	345	378	527	436	252	36	182	45
Rhode Island				55	157	8	137	90	9	13	189	6	37	16
Connecticut				478	654	121	131	121	214	219	378	46	114	17
Middle Atlantic				6,344	7,534	2,994	1,979	1,963	3,548	8,100	888	661	2,193	437
New York				4,043	5,074	1,372	1,149	1,365	1,811	6,091	675	291	1,100	223
New Jersey				866	1,513	809	296	257	952	552	85	250	351	58
Pennsylvania				1,435	947	813	534	341	785	1,457	128	120	742	156
East North Central				7,270	9,928	4,021	3,451	6,087	2,581	3,223	2,249	948	1,349	3,644
Ohio				1,833	1,796	1,151	1,480	718	463	1,171	184	157	490	647
Indiana				598	1,147	383	259	453	203	334	106	97	117	682
Illinois				1,941	2,910	1,100	860	2,554	1,104	560	1,576	487	375	583
Michigan				2,029	2,909	775	646	1,091	215	884	175	162	270	1,228
Wisconsin				869	1,166	612	206	1,271	596	274	206	45	97	504
West North Central				3,606	6,693	5,063	967	7,668	1,195	1,212	1,469	529	510	2,353
Minnesota				586	1,893	1,442	249	3,183	288	560	111	83	303	258
Iowa				1,399	1,217	1,236	176	533	320	204	204	72	41	930
Missouri				412	1,319	319	131	1,267	299	187	210	87	40	314
North Dakota				42	451	130	84	492	17	53	24	21	20	46
South Dakota				192	406	890	26	380	21	8	15	15	28	84
Nebraska				457	681	717	210	645	120	84	144	142	29	184
Kansas				518	726	329	91	1,068	130	116	761	109	49	537
South Atlantic				4,641	1,995	4,605	1,180	1,329	1,321	2,919	245	373	1,937	1,085
Delaware				40	46	128	115	32	29	93	7	17	25	2
Maryland				706	315	183	157	129	133	508	24	17	238	15
District of Columbia				184	106	136	25	36	139	194	12	5	76	8
Virginia				1,200	337	567	173	142	335	756	61	44	155	241
West Virginia				376	343	179	146	76	66	222	30	49	49	662
North Carolina				756	229	2,516	300	157	159	861	36	82	168	74
South Carolina				431	110	381	66	21	189	73	19	67	165	19
Georgia				477	227	230	89	165	128	104	28	49	798	30
Florida				471	282	285	111	571	143	108	28	43	263	34
East South Central				1,928	1,834	946	403	1,017	738	1,131	248	438	1,792	368
Kentucky				692	687	201	124	114	68	767	156	136	219	223
Tennessee				561	545	374	172	183	437	132	17	167	545	48
Alabama				282	243	206	50	378	153	103	39	72	871	54
Mississippi				393	359	165	57	342	80	129	36	63	157	43

[1] Estimated.

TABLE 15.—*Reported cases of acute poliomyelitis: United States, each division and State, 1920–50*—Continued

Area	1953 [1]	1952	1951	1950	1949	1948	1947	1946	1945	1944	1943	1942	1941	1940
West South Central				4,057	4,894	2,443	379	2,203	1,400	495	2,017	487	316	502
Arkansas				337	992	146	83	408	69	44	77	151	58	29
Louisiana				409	227	163	54	382	135	159	72	63	73	131
Oklahoma				533	1,320	369	59	434	200	54	594	30	61	155
Texas				2,778	2,355	1,765	183	979	996	238	1,274	243	123	187
Mountain				869	2,070	874	596	1,676	592	220	996	164	149	361
Montana				48	88	65	27	129	82	39	26	13	33	108
Idaho				161	510	122	371	48	24	15	15	6	10	66
Wyoming				47	120	82	18	122	24	10	31	17	14	42
Colorado				205	608	126	66	900	146	64	289	39	26	40
New Mexico				134	196	79	40	166	25	23	77	27	10	26
Arizona				168	179	172	38	147	25	34	138	34	15	15
Utah				81	284	206	28	148	255	25	399	25	41	62
Nevada				25	25	22	8	16	11	10	21	3		2
Pacific				3,368	3,655	6,387	1,144	2,866	1,316	930	3,463	387	399	952
Washington				635	590	585	168	519	333	205	352	33	74	449
Oregon				520	325	220	112	155	69	239	413	23	84	64
California				2,213	2,740	5,782	864	2,192	914	486	2,698	331	241	439

Area	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930
United States	7,343	1,705	9,514	4,523	10,839	7,510	5,043	3,820	15,872	9,220
New England	153	76	673	126	2,451	134	583	192	3,035	803
Maine	6	16	136	39	160	25	67	62	121	162
New Hampshire	4	3	25	5	67	7	14	7	73	26
Vermont	33	13	38	11	73	10	51	23	111	18
Massachusetts	76	18	349	51	1,390	76	353	61	1,428	503
Rhode Island	6	7	21	4	359	2	20	10	169	23
Connecticut	28	19	104	16	402	14	78	29	1,133	71
Middle Atlantic	1,713	240	1,132	352	3,602	419	2,027	1,806	7,575	974
New York	1,041	115	636	194	2,866	222	1,386	334	6,189	738
New Jersey	230	40	160	28	512	62	234	361	975	59
Pennsylvania	442	85	336	130	224	135	407	1,111	411	177
East North Central	1,410	275	2,172	1,283	1,062	941	768	480	2,846	1,873
Ohio	152	55	533	340	89	286	358	81	227	920
Indiana	56	17	146	55	49	74	46	29	60	165
Illinois	192	106	780	689	244	214	207	203	700	402
Michigan	904	59	421	152	614	230	93	112	1,137	208
Wisconsin	106	38	292	47	66	137	64	55	722	178

[1] Estimated.

West North Central	942	169	1,497	367	295	345	662	311	1,221	2,126
Minnesota	564	47	355	37	99	113	377	123	822	473
Iowa	197	40	241	76	65	37	45	51	167	222
Missouri	29	26	393	105	52	37	40	20	83	259
North Dakota	18	8	7	17	12	11	82	30	43	44
South Dakota	32	28	37	13	16	45	37	15	36	147
Nebraska	50	13	218	27	16	23	26	31	38	287
Kansas	52	7	246	92	35	79	55	41	32	694
South Atlantic	896	306	531	473	1,693	354	301	335	426	413
Delaware	8	2	8	1	6	3	7	11	6	6
Maryland	27	18	82	37	107	28	44	35	50	43
District of Columbia	19	28	30	7	85	10	12	39	17	11
Virginia	46	59	68	68	688	83	38	63	68	119
West Virginia	64	17	68	63	41	85	93	42	81	47
North Carolina	116	50	106	52	675	45	30	54	104	96
South Carolina	444	29	42	46	39	36	29	41	51	59
Georgia	106	71	92	157	36	48	41	42	32	21
Florida	66	32	35	42	16	16	7	8	17	11
East South Central	276	245	688	1,003	501	264	204	176	164	184
Kentucky	171	38	128	89	333	118	44	52		
Tennessee	34	39	127	385	91	61	118	56	53	70
Alabama	45	99	82	391	61	50	28	35	57	68
Mississippi	26	69	351	138	16	35	14	33	54	46
West South Central	366	178	1,588	287	223	208	97	153	83	682
Arkansas	49	34	344	57	28	13	13	14	17	80
Louisiana	20	45	138	35	104	27	31	43	33	310
Oklahoma	65	36	469	127	12	16		24		158
Texas	232	63	637	68	79	152	53	72	33	134
Mountain	496	66	393	126	87	686	105	71	128	251
Montana	6	14	31	12	7	322	13	9	58	20
Idaho	36	12	15	21	6	156	9	9	15	18
Wyoming	8	4	40	7	2	9	11	11	9	60
Colorado	138	13	218	33	22	20	7	9	7	76
New Mexico	108	11	25	30	10	17	9	10	16	37
Arizona	93	9	25	14	25	131	31	11	12	29
Utah	105	3	33	7	11	15	23	11	10	6
Nevada	2		6	2	4	16	2	1	1	5
Pacific	1,091	150	840	506	925	4,159	296	296	394	1,914
Washington	27	18	87	77	46	741	99	84	86	51
Oregon	58	15	63	40	50	80	36	21	16	28
California	1,006	117	690	389	829	3,338	170	191	292	1,835

TABLE 15.—*Reported cases of acute poliomyelitis: United States, each division and State, 1920–50*—Continued

Area	1929	1928	1927	1926	1925	1924	1923	1922	1921	1920
United States	2,882	5,169	10,533	2,750	6,104	5,262	3,489	2,255	6,301	2,338
New England	206	638	1,664	333	385	522	381	428	425	805
Maine	12	49	135	16	29	139	14	23	26	34
New Hampshire	8	21	51	6	21	40	6	12	12	16
Vermont	38	49	36	21	81	13	43	24	63	--
Massachusetts	119	434	1,189	245	167	192	223	217	233	696
Rhode Island	11	15	65	12	37	18	7	105	5	18
Connecticut	18	70	188	33	50	120	88	47	86	41
Middle Atlantic	751	1,321	1,725	832	1,142	1,462	1,329	816	1,563	409
New York	495	1,021	916	674	793	1,210	943	610	1,149	214
New Jersey	59	82	332	58	166	86	211	115	170	51
Pennsylvania	197	218	477	100	183	166	175	91	244	144
East North Central	489	563	2,264	455	959	1,207	419	321	1,785	529
Ohio	180	291	1,170	140	227	157	82	63	288	68
Indiana	25	34	153	37	58	78	27	--	80	29
Illinois	52	106	480	127	262	257	217	134	678	287
Michigan	180	77	284	107	99	647	39	43	480	61
Wisconsin	22	55	177	44	313	68	54	81	259	84
West North Central	186	562	936	211	1,675	388	645	149	1,102	173
Minnesota	33	224	140	44	929	144	81	51	706	80
Iowa	76	37	109	19	179	65	208	21	170	32
Missouri	19	33	273	19	122	28	53	--	--	--
North Dakota	19	138	27	24	154	72	23	16	44	9
South Dakota	4	49	76	19	44	38	25	16	37	13
Nebraska	9	41	115	20	125	14	107	24	64	13
Kansas	26	40	196	66	122	27	148	21	81	26
South Atlantic	609	776	533	429	480	496	250	158	497	196
Delaware	8	10	4	11	4	1	--	2	3	1
Maryland	21	289	31	46	50	277	27	39	221	47
District of Columbia	6	36	14	6	22	23	19	5	40	3
Virginia	325	97	72	67	94	127	147	78	131	76
West Virginia	71	190	229	10	17	24	24	12	43	10
North Carolina	133	51	24	112	79	16	15	30	36	24
South Carolina	78	68	99	148	125	11	--	--	--	--
Georgia	24	12	21	13	30	10	4	16	15	23
Florida	33	23	39	16	59	7	14	16	8	6
East South Central	209	225	372	116	204	51	88	75	65	73
Kentucky	--	59	195	--	82	--	21	--	--	7
Tennessee	123	46	91	30	--	--	--	21	16	--
Alabama	58	61	30	37	75	26	24	33	--	--
Mississippi	28	59	56	49	47	25	43	21	49	66
West South Central	32	103	557	98	129	47	63	80	66	24
Arkansas	4	10	61	10	10	4	18	8	20	9
Louisiana	11	21	73	21	31	19	30	35	17	12
Oklahoma	17	38	157	32	38	7	--	--	--	--
Texas	--	34	266	35	50	17	15	37	19	3

Mountain	71	256	523	54	171	236	35	102	102	41
Montana	7	65	22	12	41	183	16	47	26	25
Idaho	15	47	39	7	10	11			38	
Wyoming	4	5	12	4	10	3	4	8	3	3
Colorado	13	76	77	12	23	8	8	12	16	10
New Mexico	9	10	200	8	12	6	2	7	6	3
Arizona	9	19	72	3	37	3	3		2	
Utah	8	23	88	8	11	5	2	25	9	
Nevada	6	9	13		27	17		3	2	
Pacific	239	725	1,959	222	959	853	279	86	696	88
Washington	31	343	292	16	115	592	22	18	336	10
Oregon	36	84	340	19	23	69	7	5	78	6
California	172	298	1,277	187	821	192	250	63	282	72

Dr. ANDREWS. Mr. Chairman and members of the committee and moderator, I can recapitulate very briefly the content of this statement which recounts the research interest of the Public Health Service in polio dating from 1910, when its scientists commenced studying the occurrence of the disease in nature.

The period immediately after this was by no means an unproductive one in spite of the fact that most of our major advances of knowledge in polio had been made in the last 15 years. It was deduced by these field studies that although only a small proportion of any population actually develops the real symptoms of infantile paralysis, many other persons must have been silently infected and immunized as a result, and these individuals should have protective antibodies, a fact later confirmed on the basis of this concept of people with clinical paralysis, people with symptoms that were something short of paralysis, and people that had no symptoms at all.

In 1939 one of the scientists at the National Institute of Health was able to grow the virus in a small animal, in rats and in mice. This aided immeasurably in cutting down the costs of maintaining the virus in laboratories. Previously it had to be done in large animals, monkeys, and so forth. Later, the other two strains of virus were adapted by Public Health Service scientists also to small animals.

The field research which has been done by the Public Health Service has contributed perhaps more from a negative standpoint than from a positive one.

By the end of the war it was known that the virus of poliomyelitis could be found in sewage and in flies. The dramatic success which DDT had experienced in reducing the fly densities led the public to believe perhaps it would be possible to control poliomyelitis by fly control using these new techniques.

The Public Health Service embarked on a large and expensive series of observations which showed in the long run that flies could hardly be an important vector of poliomyelitis, and confirmed the beliefs of most people that the disease was spread primarily by contact from person to person.

Other contributions of the Public Health Service include improvements in the diagnostic and identification techniques within the laboratory, and continued field investigations which are now being carried on in Phoenix, Ariz., and Charleston, W. Va., surveys of the antibody level in populations where poliomyelitis is almost a year-round occurrence, as it is in Phoenix, in contrast to the situation where it is purely seasonal, as it is in Charleston.

It has been possible, with the assistance of one of the grantees of the National Foundation for Infantile Paralysis, the Yale poliomyelitis study unit, directed by Dr. Paul, who sits to my right, to carry on a great deal of work from the standpoint of obtaining the pattern of antibody prevalence, concentration, and persistence in these populations.

In the effort to adapt to mice one of these strains of poliomyelitis virus—the strain known as the Brunhilde strain—it was found that this particular adapted strain had certain remarkable characteristics. It appeared to have lost much if not all of its capacity to produce paralysis in monkeys, and at the same time it remained capable of immunizing these animals against subsequent infection with the same strain of that virus.

It remains to be seen, of course, whether or not these characteristics are genetically stable.

If this is confirmed, however, it would seem that this offers another approach toward the possibility of prophylactic vaccines utilizing the same biological prevention principle that we have in vaccines against yellow fever, foot-and-mouth disease, hog cholera, and other various diseases, namely, protection by deliberate infection with an attenuated strain of the causative agent which has lost its capacity to produce the disease without losing its ability to immunize.

We are hoping that time and other facilities will permit us to explore this possibility further.

That is all I have.

The CHAIRMAN. Are there any questions?

Doctor, just what is the activity of the Public Health organization in seeking control of poliomyelitis? Just what does it do? You have a great many buildings out there. This committee has had a very large part in starting these different researches. One above all of them which has attracted a great deal of attention among the members of the committee is polio. I assume it is because it strikes children in their own homes. Just what is being done with respect to that?

Dr. ANDREWS. Mr. Moderator, I would like to invite the participation of Dr. Haas, if I may, in answering this question, because the work in the Public Health Service is being carried on in two major subdivisions of that Service.

The CHAIRMAN. If Dr. Haas is going to speak on it, Doctor, I will not press the question at the present time.

Dr. ANDREWS. I can say in general that most of our activities have been concerned with research aimed at understanding the nature of the disease, the methods by which it is spread, improvements in the laboratory diagnosis of the disease, and looking forward, as is everyone else, to the development of a preventive technique.

In addition to the research, however, the Public Health Service has undertaken to train some of the State health laboratory officials in the application of these newer methods of diagnosis which Dr. Van Riper has mentioned, so that the States themselves will be able to make application of this new and simplified knowledge.

Furthermore, the Public Health Service always stands ready to assist State health officers who are faced with epidemics from this disease. I must say there is not a great deal that one has been able to do in the past, but such assistance as could be rendered has been made available to them.

The CHAIRMAN. Does your research utilize the use of patients?

Dr. ANDREWS. It has not thus far. I think Dr. Haas may want to tell you something about the contemplated use of the Clinical Center in that connection.

Dr. SABIN. I cannot go on with this discussion without paying tribute myself to the many contributions which have come from the Public Health Service. It must be realized that while you gentlemen may be hearing 1 or 2 names mentioned in connection with some piece of work, that it actually represents the cumulative results of the work of a great many people. The contribution that Dr. Armstrong had made in 1939 in getting the virus first of all adapted to mice permitted very great progress in our understanding of how the disease behaves in the United States and other parts of the world. Subsequent

work, particularly with the facilities of the Public Health Service, and having people in the field, has made it possible to study the natural history in cooperation with others.

Now I think I would like to bring out some of the points that are listed on the agenda here rather quickly, which might have been covered.

Under item 4 is the question: "What is the human dimension of poliomyelitis in the United States today?"

Dr. Van Riper, I believe, has covered most of that. He has, for example, indicated that by age group at the present time there is a considerable proportion among those who are over 10 years of age, and particularly among women even over 20 years of age.

Now, as to area. While that has not been brought out, I wonder if either Dr. Paul or Dr. Hammon might wish to say something about the relative incidence of paralytic poliomyelitis in different parts of the United States. That would be of interest to this committee, Mr. Chairman. Dr. Paul, would you like to say something first on that?

STATEMENT OF DR. JOHN R. PAUL, YALE UNIVERSITY SCHOOL OF MEDICINE, NEW HAVEN, CONN.

Dr. PAUL. As Dr. Sabin has already intimated, this disease is worldwide in distribution and there is no part of the inhabited world that one might imagine that this disease might not someday visit. However, the actual reports of its presence differ enormously.

In the countries which have the highest standards of public-health practices—and I make this as a generalization—by and large poliomyelitis seems to be increasing. These would be Scandinavia, England, Canada, Australia, and the United States most prominently of all. The numbers of reported cases are on the upgrade.

There are a number of possible explanations for that, which I do not think I should try to go into, because the matter is not settled and it is somewhat controversial. But we face a disease which, unlike many of the other infectious diseases, is on the increase rather than the decrease, which seems definite.

However, one important discovery has been made regarding area. It had been previously thought that this disease was rare in the Tropics; that people who lived on the Equator seldom had it. That does not seem to be the case.

Actually, what they have is a very—I say this advisedly—much milder form of the disease as it attacks very young infants. That is the old-fashioned infantile paralysis, which was the way the disease existed in this country 50 years ago. Usually this situation of the disease attacking young children is found in areas where sanitary conditions are not as good, where tropical diseases are rife.

In other words, the explanation given is that the child has more opportunity to come in contact with the virus than he would have in Washington, D. C., or New York City. So there is an area distinction to be made as to what age the disease attacks individuals. That is an important point in mapping out programs for the control of the disease, I think. It no doubt will be brought out later.

In a given city in this country among the people who are underprivileged one finds that the disease appears at a younger age than

for those who live under the best of circumstances. These are important points that we are just beginning to realize.

That would be, in brief, all I would care to say about that.

Dr. SABIN. I wonder if before you complete your remarks you would specifically make a statement about the role of area in the United States rather than in the world.

About 20 years ago we had statistics which indicated that the reported cases of paralytic poliomyelitis were much more in the North and Northwest and East than in most of the States of the South, where they had a relatively much lower incidence of the disease. Could you say what the status is at the present time with reference to the distribution of paralytic poliomyelitis in the different parts of the United States?

Dr. PAUL. I would have to quote, Dr. Sabin, from figures I do not have before me. By and large, those that have been published by Dr. Gilliam and others indicate there is about twice as much of the paralytic disease—at least, there was up to 1938—in the northern half of the country than there was in the southern half. Perhaps there is someone else who has those figures available to give in a generalized form.

Dr. SABIN. Would you comment, Dr. Hammon, particularly on the distribution of paralytic poliomyelitis in different parts of the United States?

STATEMENT OF DR. W. McD. HAMMON, HEAD OF DEPARTMENT OF EPIDEMIOLOGY AND MICROBIOLOGY, UNIVERSITY OF PITTSBURGH, PITTSBURGH, PA.

Dr. HAMMON. I cannot give you the figures, because I do not have them with me, which Dr. Paul has mentioned. I think I can certainly confirm the general statement he has made and supplement it slightly.

In the southern part of the United States, where we have many more months of warm weather during the year, children appear to get the paralytic form of the disease at a much earlier age. We believe poliomyelitis is spread for some reason or other particularly in the warm seasons. That is when the epidemic peaks occur.

In the South we have many more months of warm weather. The possibility of a very young child getting in contact with the disease in the Southern States, therefore, at an early age is greater. He has more months of summertime weather and exposure within the first few years of life than occurs in the Northern States. So we see younger cases in the South than we do in the North.

At the same time that children are getting infected, producing the diagnosed cases, there are a larger number being infected who are either not ill or only mildly ill with the form of the disease which cannot be diagnosed. Therefore, immunity rates in a vast majority of the population are higher.

Children, let us say above 3 years of age, have a much higher immunity rate in the South because of earlier infection. There are more susceptibles at the higher age in the North. This has been confirmed by surveys made by testing serum from persons of all ages in the South and in the North.

Therefore, there is a larger number of susceptible persons in the Northern States, with fewer of them getting the disease in its milder form, which seems to occur in the very young infants, and there are actually more cases of paralytic poliomyelitis in the Northern States than there are in the Southern States.

Now, with regard to economic groups within any one city, we have made several such surveys. Dr. Paul has made such surveys, and others have, also, with respect to ages at which the children become infected, which shows up the proportion that have antibodies at any specific age.

There, again, it has been found that the age of infection is earlier in the lower economic group than it is in the higher economic group. A few studies have been made attempting to find out whether the actually paralytic disease occurs more frequently or less frequently in the two economic groups. The results of those studies, which are few in nature but highly suggestive, would indicate that there are more cases of paralytic poliomyelitis in the higher economic groups than there are in the lower economic groups.

There seems to be an advantage in getting the polio infection very early in life. The milder forms or the inapparent forms of the disease are more likely to occur at that early age.

Dr. SABIN. I think I should perhaps make it clear, so that you will understand the testimony of these people, that a differentiation must be made as between an infection of the virus and paralysis by the virus. When it is said that there is a lower incidence of paralysis reported from the South or from certain other sections of the world, studies have shown that there is, indeed, more infection in those particular countries at any one time. On the other hand, as Dr. Hammon has pointed out, in the North and Northwest, where there is now greater incidence of the disease, there is less infection.

It is a paradox. You can almost say without being absolutely mathematical about it, that there is an inverse relationship between the amount of infection that is being spread around in any one area and the number of cases of paralysis.

We will not go into the reasons for it. They might be controversial. But I think the facts will probably be admitted.

Mr. THORNBERRY. Before you all leave that subject, I did want some explanation of it, and I think what you have said is helpful. When we started the discussion on that point you asked as to the proportion, as I understood it, of paralytic cases.

Dr. SABIN. Right.

Mr. THORNBERRY. And then got off into the discussion of the incidence of infection as compared to the actual paralysis. Am I correct now in deducting from what has been said that the number of infections or the incidence of infections in the South is greater than it is in the North and Northwest; but that the incidence of actual paralysis is greater in the North and Northwest than it is in the South?

Dr. SABIN. In general that would be my conclusion. If there are any dissenting opinions from that we might have them for the record.

Mr. THORNBERRY. That is what I would like to know. Is that right? Dr. Hammon over here said, as I understood it, that there was a greater incidence of infection in the South among the children. I

was not quite sure whether he meant that actual paralysis resulted or not.

Dr. HAMMON. Not only a larger number of infections in the South, but they occur earlier in life. Both are true. There is a greater number of infections and they occur earlier in life.

Mr. THORNBERRY. But the paralysis as a result of the infection is greater in the North and Northwest than it is in the South; is that correct?

Dr. HAMMON. That is correct.

Dr. PAUL. Perhaps it might be put this way: Using round numbers, infants under the age of 3 or 4 have a ratio of, let us say, something like 1 case of paralysis in 500 infected.

Mr. THORNBERRY. Yes.

Dr. PAUL. Whereas an older child has a ratio of 1 case of paralysis in 100 infected. Those figures are far from exact, but that is the trend I would like to emphasize.

Mr. THORNBERRY. All right.

Dr. SABIN. That would be over a period of years, and not necessarily in any one epidemic.

Mr. THORNBERRY. One more question, please. You said your conclusion was true up to a certain year. What year did you name? Do you recall?

Dr. PAUL. I do not believe I mentioned a year, did I, sir?

Dr. SABIN. Perhaps you have in mind the statement I made that the statistics from the Public Health Service up to 20 years ago showed a very marked discrepancy between the numbers of reported cases from the South and from the North. Perhaps the conclusion from this discussion to be drawn is that while the discrepancy may not be as great now, 20 years later, the difference is still there.

Is that a correct interpretation? Do we all agree on that?

If we do, the next question is "Number of deaths and extent of disability."

This question was covered by the report presented by Dr. Van Riper, who drew the important point which I think has to be stressed again and again in discussing poliomyelitis. Poliomyelitis differs from scarlet fever or measles or certain other things. It is a cumulative disease. The people who get it, or a certain proportion of them, live on and need care for many years. Therefore, in 1953 you have not only the patients who had the disease in 1953 but you still have the people who had it in 1923, 1933, and 1943.

Next, is the disease increasing or decreasing? Now, Dr. Paul has covered that in part in his discussion.

Certainly in the United States, if you take the records from 1945 to the present, there has been a yearly increase in the reported cases.

There may always be a little argument among the experts and specialists as to whether it is being reported more, whether the doctors are more conscious because of all of these chapters of the National Foundation for Infantile Paralysis, or whether the disease is really increasing in diagnosable form.

My own impression is that people were probably quite as conscious in the early 1930's about poliomyelitis in the United States as they have been subsequently. My own impression is that the disease,

diagnosable disease, is increasing, and that perhaps one of the factors contributing to its increase after the war is the greater travel which is constantly going on, with the different viruses that are being disseminated by greater association and opportunities for spread, which are indeed responsible for the larger numbers particularly in those population groups which do not have an opportunity to get immunized early in life by the various natural processes.

Now, let us get for the record the consensus of those present here. Is the disease increasing or is it only seemingly increasing?

Would anybody disagree here that in the United States, at least, and in certain other parts of the world, there is more clinically diagnosed poliomyelitis in the last 5 years than there was in the preceding decade? Is it on the increase? I will call for volunteers.

Dr. HAMMON. I would like to simply correct one word. You said "diagnosed." Make it "diagnosable."

Dr. SABIN. I said "diagnosable." I probably did not enunciate it properly.

Dr. HAMMON. The last time you said it you said "diagnosed."

Dr. SABIN. I am glad you said that, because it underlines the significance of the word "diagnosable," and it really brings out the fact that there is a large iceberg that is submerged of infection which cannot now be diagnosed.

What is important in poliomyelitis is not that infection that gives rise to a little bit of headache or nothing at all, but rather that which produces paralysis. That is why the diagnosable part of poliomyelitis is the important part.

We are not getting testimony on the increase or decrease or stationary status of the diagnosable poliomyelitis, particularly paralytic poliomyelitis. Dr. Andrews?

Dr. ANDREWS. I should like to call the attention of the committee to certain appendixes which have been attached to the Public Health Service statement. One is an analysis of the poliomyelitis distribution in the United States, which shows that on the basis of reported cases, at least, there has been geographically an increase in the number of cases; and in recent years an increase in the number of persons certified as having died from poliomyelitis.

The officially reported numbers of cases and numbers of deaths are appended to the statement, also.

Dr. SABIN. Are there any other remarks relative to this? Can this committee then draw the conclusion that it is the testimony of this group that diagnosable poliomyelitis, especially the paralytic form, is actually on the increase? Will anybody dissent from that statement?

Now that I have clearly enunciated "diagnosable," if there is no dissent I think we can proceed.

I hope I will be permitted this comment: That at least in my opinion the reason for that increase is improved public health practice, improved sanitation and hygiene. Paradoxically I think that gives rise to an increase in diagnosable poliomyelitis, because it cuts down the opportunities for infection with either mild strains or very small doses which do not give rise to paralysis.

The second important cause—and this is strictly a personal opinion—is that the greater travel of persons all over the world, which has particularly become so prominent after World War II, is in

part contributing to this, and I think that we may expect more rather than less diagnosable poliomyelitis.

Next we come to something that I had down here under No. 5.

What is known medically about this disease today?

It seems that we have taken more time about the discussion of the other questions, and since Miss Switzer has to leave I would like, with your permission, to move on to item 6 on the agenda, and particularly ask Miss Switzer to tell us about the work of her particular Office of Vocational Rehabilitation in the field of poliomyelitis.

STATEMENT OF MISS MARY E. SWITZER, DIRECTOR, OFFICE OF VOCATIONAL REHABILITATION, WASHINGTON, D. C.

Miss SWITZER. Thank you, Dr. Sabin.

Mr. Chairman, we are very glad that the panel decided to include rehabilitation as part of the general area for the consideration of your committee. As I watched fairly interestedly in the last several days the very fine testimony that was given on the great crippling diseases you have been studying, I could not help but reflect that in those areas where science and medicine still have not found all the answers—in cancer and heart and in the major neurological diseases, including blindness and deafness and many other things that result in crippling conditions for people—the only thing we have to offer, really, after the disease has once been contracted and medical science has done all that it can in the way of treatment, is rehabilitation. Until we can find the answers for prevention and cure of many of these diseases in which this committee has taken such a tremendous interest and has done so much about, rehabilitation offers about as good a positive approach for the long pull as anything.

I am particularly pleased to be able to present to you some of the facts about rehabilitation in relation to polio, for several reasons. First of all, I have a personal reason, because of my personal association with the national foundation, which has been of long standing and has been very intimate. I feel that it represents one of the great voluntary efforts of our whole field of medical and related sciences.

Another reason is because in the work on public programs of vocational rehabilitation there has always been a close working relationship between the chapters—the local and State chapters, as well as the national organization—and the local rehabilitation agencies throughout the country. We have had a written cooperative agreement since the middle 1940's. We have constantly and consistently worked together to supplement the work of each other.

I think that the figures and the information which we can provide to you on polio illustrate the whole field of rehabilitation and dramatize the possibilities and the failures which we want to consider.

The public program of vocational rehabilitation is a traditionally organized Federal-State program of service. It has been in existence since 1920.

Now, in 1920 as part of the national program for vocational educational, a small start was made in providing for services to retrain civilians who had been injured in industry and by disease, and to bring them back to work. Even as long ago as the early days of the

program, when the number of people handled in the course of a year, perhaps, was not more than 8,000 or 9,000, in contrast to the 60,000 or 65,000 in later years, there was always a certain number of people, usually orthopedically crippled by polio, who were the beneficiaries of the vocational rehabilitation program.

Little by little from 1920 to 1943 the Federal Government increased its interest and its support of this program. But up to 1943 it was largely a vocational training program, and very little medical rehabilitation was provided through it.

Since it was traditionally educational in character it was, and in fact, still is, in the States administered by the State boards for vocational education, except where there is a separate agency for services to the blind.

In 1943 there were far-reaching amendments to the basic vocational education law, and those amendments provided for comprehensive medical rehabilitation services to those who could benefit from them and who were in need of them.

From that time on there has been a constantly increasing interest in and a very marked improvement in our national system of vocational rehabilitation services.

Now, these services primarily are geared to bring our services to the working population, so that in the field of polio quite naturally—and we have provided some little fact sheets for your ready reference—the average age of people crippled by polio that our service benefits is an age younger than the national average by a number of years. For example, 22 is the average age.

Last year our program was responsible for the return to work and normal living of about 4,000 people who were crippled and disabled by polio. I would like to say here that that brings out 1 or 2 facts which have been mentioned earlier. It underlines, I think, what Dr. Sabin has just said, that the results of polio are cumulative and that, while the majority of people affected are very young and consequently the extent of their disability in relation to their life's destiny is never fully known until they are grown, until they are willing to go out from their families or until their families are no longer able to support them, we are still faced with the vast magnitude of the problem of dependency when perhaps a child who contracted polio very early, who was protected and trained in special classes at school, or who did not realize that not being able to move around was any handicap, finds when he is ready to go to work that he is confined to a wheelchair, and for all practical purposes is completely and totally disabled.

In the last 4 or 5 years, particularly since World War II, we have had the benefit of the comprehensive rehabilitation services demonstrated, so that people who have been through the years practically bedridden have become able to walk again. There are the miracles of returning people to the activities of daily living and their work, which are one of the great factors we can underline as a positive result of the medical possibilities in the treatment of polio and many other of the chronic diseases.

Now, our program picks up where the national foundation's program of medical care leaves off; or perhaps I should say it is supposed to pick up there because, as Mr. Thornberry brought out, the ex-

penses of doing everything that is possible about polio are almost more than any individual family can bear.

But if you were to add onto that the expenses of a comprehensive rehabilitation program you would have very few people able to sustain themselves in that program.

Another reason why I am very glad to discuss rehabilitation with you in relation to the national foundation's program is that they, too, have realized that rehabilitation is a part of their total concern for the polio patient. While they say to us very earnestly and emphatically that they expect the public program to do the job of vocational rehabilitation for the victims of infantile paralysis, nevertheless they recognize the inadequacies of personnel and facilities, and at every step of the way they use their resources as they have in the field of research, to stimulate training and to stimulate better community work for the giving of these services.

Now I have one final comment concerning the possibilities of relating the results of our failure to do something about the victims of polio to the total responsibilities that cut across all disease lines. I will not, Dr. Sabin, go into the details of medical rehabilitation or some of the dramatic things that can be told, because I think that will fit more logically later on in the discussion of medical care, and Dr. Wise, who happily is also associated with the foundation's efforts in medical education and rehabilitation, will be able to deal with that very fully later in the day.

I would like merely just to make a part of the record a few statistical statements on this whole field of disability and its relation to dependency, of which polio is one segment. Heart and cancer and multiple sclerosis and the other neurological diseases all make up the total pie of very great proportions.

We realize that there are probably 2 million to 4 million to 6 million people, depending upon whom you count and whether you count people in institutions or include the mentally ill or not, who should be benefiting from vocational rehabilitation and who could benefit from it and who would be productive workers if they were able to have the services. Each year about 250,000 more are added to that backlog.

Last year the program, the publicly supported program, rehabilitated about 63,000 or 64,000 people. That was a good year. Now, those people, of whom about 4,000 were polio patients, are quite important. I think it is interesting to just speak in economic terms, and we will speak about the polio group first, because, after all, that is what we are most interested in.

They were a young group. Remember, they had an average age of 22. So only a very small proportion of them had yet found their way to the relief rolls. They were, rather, supported by their families and others. Most of them were unemployed when they needed and applied for rehabilitation. They were earning about $728,000 a year then. After rehabilitation, when they had been in their first job for 3 to 6 months, they were earning $7.4 million a year. So just that simple statistical fact, in addition to all of the human and humanitarian aspects of the program, shows the economic significance.

Now, when you take the total program for the 66,000 people who were rehabilitated last year, and you realize that the vast majority of them were not employed and that about 12,000 of them were on relief

and had been on relief for a number of years before they were rehabilitated, you get a little picture of what rehabilitation means in the long pull. I think it is easy to dramatize it for ourselves in relation to polio, because the majority of people afflicted and crippled with polio are young when it strikes them. They have a lifetime ahead of them.

Many, many of the people who require service after they have been crippled for 20 or 30 or 40 years would not have required it if it could have been made available to them immediately following their acute phase.

With what we know today about rehabilitation and with what the country is gradually becoming aware of as to the possibilities of the manpower potential in rehabilitating handicapped people, there is no excuse for our not carrying it on into their rehabilitation, so that wherever possible and to the extent possible they can remain or return to full community participation.

Dr. Van Riper's illustration of the doctor in the iron lung who by his own will and by the skill that was made available to him in that very specialized center in California has done this great work is just one example of the many ways that patients could benefit, even though it looks as though they are almost hopelessly involved. Many times they can in a very large measure be self-sustaining.

We have any number of examples of young mothers, housewives, heads of families, who, after they have been given the maximum amount of training, have been taught to walk, to get up and down curbs, to get in and out of buses, and have been taught to organize their kitchens so that they can do their own housework.

I have a little paraplegic secretary who was the victim of polio when she was quite young who does a superb job of running my office. She is married and keeps her own house and, in addition to that, is the major support of her mother and father.

So the dramatic possibilities of the program are just beginning to be felt. As you hear more and more of the exciting possibilities for the future when we may prevent this disease, remember that even if tomorrow we were able to find a vaccine or a method of wiping out polio, like smallpox, or guaranteeing that we would not have another case in our country except by a fluke, we have 10 or 15 years of work ahead of us on those who have been the victims of polio during this past quarter of a century.

Dr. SABIN. Thank you very much.

Mr. Chairman, since Miss Switzer will be leaving us, I think now is the time to ask any questions, although she has given a very clear presentation.

The CHAIRMAN. Miss Switzer, we appreciate very much this very full and comprehensive and informative statement you have made. That, together with the pamphlet entitled "Facts in Brief" which you have left with us, will be made a part of the record. That will certainly make plain the work being done by your splendid organization, of which you are the Director.

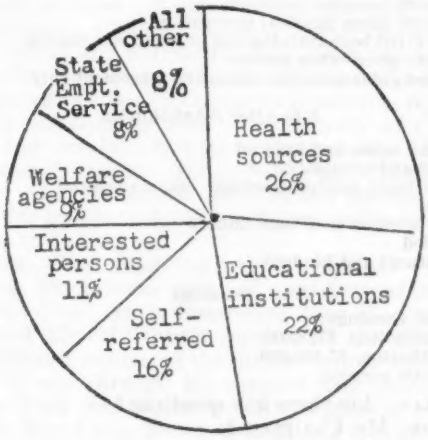
(The information is as follows:)

PERSONS DISABLED BY POLIOMYELITIS REHABILITATED IN FISCAL YEAR 1951—FACTS IN BRIEF

(Rehabilitation Service Series No. 208, Federal Security Agency, Office of Vocational Rehabilitation, October 1952)

POLIOMYELITIS REHABILITANTS—3,801 WERE REHABILITATED DURING 1951

Referral sources



General characteristics

65 percent were male
95 percent were white
75 percent were single
22 years was their average age at time of acceptance
11 years—average schooling

Age when disabled

49 percent were under 5 years of age
17 percent were from 5 to 9 years of age
13 percent were from 10 to 14 years of age
12 percent were from 15 to 19 years of age
4 percent were from 20 to 24 years of age
5 percent were 25 years or older

Type of impairment

	Percent
Impairment of extremities	94
Upper:	
One	8
Both	1
Lower:	
One	39
Both	31
Combination, upper-lower	15
Impairment of back	5
Amputations	1

Employment, economic status

86 percent were unemployed when accepted for rehabilitation
31 percent had never worked
69 percent were dependent upon their families
6 percent were on relief
21 percent were married and had family responsibilities
22 percent had dependents

Services provided

In addition to guidance, counseling, and placement—
49 percent were provided training
16 percent were given physical restoration
9 percent received both training and physical restoration
3 percent were given other service
23 percent received guidance, counseling, and placement only

Jobs after rehabilitation

37 percent clerical, sales, and kindred
28 percent skilled and semiskilled
16 percent professional, semiprofessional, and managerial
7 percent service
5 percent family workers and homemakers
4 percent unskilled
3 percent agricultural and kindred

Earnings

Estimated annual earnings:
Before rehabilitation, $728,000
After rehabilitation, $7,400,000
Increase of 900 percent

The CHAIRMAN. Are there any questions?

Mr. HESELTON. Mr. Chairman?

The CHAIRMAN. Mr. Heselton.

Mr. HESELTON. Miss Switzer, there are other agencies in the Federal Government engaged in rehabilitation, are there not? The Children's Bureau and the Veterans' Administration are examples?

Miss SWITZER. Well, the Veterans' Administration has the responsibility for rehabilitating all veterans whose need for it is service connected. Our program, on the other hand, is responsible for providing rehabilitation services to veterans whose injuries are not service connected.

There are more paraplegic veterans, for example, whose paraplegia is due to non-service-connected disability and for whom we have responsibility, than actually there are in the other group.

Then, of course, the armed services do a certain amount of rehabilitation. But up to the time that the veteran is transferred to the Veterans' Administration there is a great deal to be done.

I think that also I should mention that the Department of Labor, where the United States Employment Service is, has the responsibility for placement under certain conditions of the physically handicapped, where they have a special placement officer or where the services lend themselves to doing that.

Then you are all familiar, I assume, with the President's Committee on National Employ the Physically Handicapped Week, which was just last week, you know. That committee is a group of citizens of all kinds; management and labor, professional and lay; and it has its counterpart of governors' committees and local committees. They

have, I think, done an outstanding job of public education on the values of properly trained and placed handicapped workers.

Now, there are one or two other very specialized Federal agencies which I think we should mention. Mr. Thornberry would, I think, be quite critical if I omitted to mention one of our institutions he is very interested in, and that is the Columbia Institution for the Deaf and Gallaudet College which is the only institution in the world, really, where college-grade education can be given to the deaf.

We have a number of clients, as we call them, of the State vocational educational services that get their college training and specialized training at Gallaudet College. That is one of the institutions that make up their health and welfare family. Then the American Printing House for the Blind, which makes talking books and braille editions of the Reader's Digest and so on, in Louisville, Ky., is supported by the Federal Government also. The Library of Congress makes talking books and circulates talking-book machines. It spends about $1 million a year on making talking books and distributing talking-book machines, which is an indication of the interest it takes. Our appropriation for grants to the States for rehabilitation, as you know, was $23 million this past year.

Mr. HESELTON. What about the private agencies?

Miss SWITZER. The private agencies' contributions to rehabilitation are very outstanding. It is interesting how things overlap. Dr. Sabin mentioned Mr. Millbank's support of the early research on polio. Mr. Millbank was one of the earliest supporters of the rehabilitation work. It was through his support that Colonel Smith's institute in New York was begun, which did such an outstanding job between World War I and World War II and is still doing it. And there are the medical centers which are doing rehabilitation work as a result of the efforts of Dr. Rusk and of Dr. Wise's group. We have only two rehabilitation centers supported by the public program. One is in Virginia, at Fishersville, and one is at Okmulgee, Okla. The rest of the rehabilitation centers and so-called curative workshops are usually community operated, supported by a variety of community organizations, usually local philantropies. The Cleveland center, supported by local philanthropies, is doing outstanding work, and so is the center in San Francisco. About 5 years ago the Polio Foundation, realizing the importance of rehabilitation, stimulated the San Francisco center and made it possible for that center to expand.

All the way along the line most of the service that has to be purchased and provided, in common with hospital services the country over, is provided by nonpublic institutions. There are very few nonpublic institutions that have adequate rehabilitation centers. A little start was made at Gallinger and Bellevue, in New York City, is famous for its rehabilitation center.

Mr. THORNBERRY. I would like to join in thanking Miss Switzer for the very fine statement she has made. I am familiar with the rehabilitation program somewhat, particularly at the State level. I think it is a program that draws no State line, and I think, unfortunately, it is sometimes treated as a matter that should draw State lines. We appreciate your statement, Miss Switzer.

Miss SWITZER. Thank you.

The CHAIRMAN. I think the United Mine Workers also have done some work in the field of rehabilitation.

Miss SWITZER. I think it is a terrible omission that I made because the United Mine Workers made the most comprehensive contribution to rehabilitation in the last 5 years by their daring and courageous efforts for the severely disabled. Mr. Chairman, I thank you for mentioning them.

The CHAIRMAN. The statement of Miss Switzer has been so complete that the failure to mention just one would never be held against you. You made a very fine statement and one which we greatly appreciate having in our record.

Miss SWITZER. Thank you, Mr. Chairman.

Dr. SABIN. I would like to ask Miss Switzer 1 or 2 questions, particularly for the benefit of those of us not in the rehabilitation field. First, what proportion of those paralyzed by poliomyelitis who need vocational rehabilitation can get it?

Miss SWITZER. Well, probably about the same proportion as the victims of everything else, which is discouragingly small, and I am not sure but what more polio victims do not get the vocational rehabilitation they need. Here is about the way it is: About 6,000 or 7,000 people every year—let me put it this way—15 percent of the people who have serious paralytic polio and should have comprehensive rehabilitation service have not been getting it for the last 20 or 25 years. Last year we had 3,000 people with polio rehabilitated and there were 6,000 people added to the backlog. So you might say that is not too bad; that is half. But you have to remember that in that cumulative 2 million there are an unknown number of victims of polio who are not being reached and it is hard to say, but this much I would say, Dr. Sabin: that we are certainly not doing the job within 50 percent, and polio is one place we could do it totally because they are identified, and if we had sufficient community support, sufficient money, and sufficient people who could do the job, it could be done totally in polio.

Dr. SABIN. Are those the only reasons, or can you state other reasons, why those needing rehabilitation are not getting it and what in the future should be done to provide this important service to all who need it?

Miss SWITZER. I think the first thing is that there is not enough money, facilities, or personnel presently available to give rehabilitation to all who need it. If the polio victims are to get the rehabilitation through the public program, they can only expect their fair share. So the first thing is more of everything. The second thing is a more definite and more aggressive determination on the part of all of us interested in the polio victims, to see to it, especially in the younger group, that all the way down the line we do not lose any of them along the way. We should have a better referral system and better community organization and, of course, give constant attention to the mental hygiene factor, the human motivation, the setting in which they live. All you can do is to provide an atmosphere and make available services so that the individual can rehabilitate himself, so that human motivation is not a factor you can ignore. Probably, even if you had every facility and all the personnel and every dollar you needed, there would be some people you could not rehabilitate.

Dr. SABIN. What would you say the national foundation should do, and what would you say your Office of Vocational Rehabilitation should have, in order to make it possible for those now needing rehabilitation to get it; not the techniques, but what should the national foundation do in order to make it possible for all those who could be rehabilitated to obtain that rehabilitation?

Miss SWITZER. Well, I think it is not fair—and I speak now as a public official and as a contributor to the March of Dimes—I think it is not fair to expect the national foundation to do the whole job of rehabilitation, any more than it is fair to expect the United Mine Workers to do it. I think the public program of vocational rehabilitation should give more special attention to those groups that have been carried so far by their own efforts. In other words, we should have money enough, staff enough, facilities enough, and policies broad enough to permit us to pick up a polio victim the minute the national foundation finishes its definitive medical care. I must say I think ideally the foundation would like to carry the victims through to complete rehabilitation, but it cannot do it. I think money and rehabilitation facilities are the two most important factors. Would you agree, Dr. Van Riper? Maybe a little narrowmindedness enters into it, also.

Dr. VAN RIPER. You mentioned the San Francisco center. After following the outstanding work of the center at San Francisco for a matter of about 2 years, we discussed in our advisory committee meetings where the foundation's emphasis in the matter of rehabilitation should be directed, and we came up with the idea we were at this moment in rehabilitation where we were 20 years ago in scientific research. You have to train people qualified to carry out the results of scientific research. Today we are not training enough people who have an understanding of rehabilitation work. So 6 months ago grants were made and we are hoping to expand that work.

We are trying not to consider the rehabilitation of the patient as such, but to establish training centers in university hospitals where every medical student will be familiar with the total concept of rehabilitation. At the same time, graduate students are learning the technique of rehabilitation. There are 78 medical schools and I would hope there might be sufficient money to do this in all 78 medical schools. I think until that is done we will have the same problem of what to do with the physically handicapped individual who is allowed to vegetate in a wheelchair in the back room of his home or in a hospital for incurables, as it is called. It is at the moment what would seem an insurmountable task, but I think if we can aid those institutions they may in a few years become self-supporting.

I think Miss Switzer will agree that not every general hospital can set up a type of center such as you have in San Francisco or Chicago, but if every student who graduates from medical school realizes that something can be done, he himself can do something in his local community through the process of screening and sending to those centers the more complicated cases.

Dr. SABIN. I turn it back to you, sir.

The CHAIRMAN. Any further questions?

Dr. Sabin, you say you have turned it back to me. Do you mean you do not have any more witnesses?

Dr. SABIN. Not on this particular part of the information on rehabilitation. If there are no further questions, we will proceed with the agenda unless it is time to quit.

The CHAIRMAN. How many more witnesses do we have who will testify?

Dr. SABIN. On rehabilitation?

The CHAIRMAN. No, I mean on the entire subject.

Dr. SABIN. We propose to go through with this agenda rather faster from this point, I think.

The CHAIRMAN. How many witnesses do we have left?

Dr. SABIN. We have covered 4⅓ points of the agenda. Dr. Paul and Dr. Hammon still have to testify, and Dr. Price, Dr. Haas, Dr. Wise, and Dr. Barrows, to bring out the information which we are given to understand you would like to have. We can cut the agenda at any time.

The CHAIRMAN. It has come at a convenient hour to recess. Would half past 1 be agreeable to members of the committee as well as to the panel to return? I would like to finish it today if we possibly can. We realize many members of the panel have come a great distance to be here, and all are very busy individuals, and therefore I think it is important that we finish this afternoon, and as soon as possible this afternoon, to enable the taking of trains by those who have come from a great distance. So I will ask the members of the committee and the panel to return at 1:30.

(Thereupon at 12:35 p. m., a recess was taken until 1:30 p. m.)

AFTERNOON SESSION

(The committe reconvened at 1:30 p. m., the Honorable Charles A. Wolverton (chairman) presiding.)

The CHAIRMAN. The committee will come to order. Dr. Sabin, you will proceed.

Dr. SABIN. Mr. Chairman, we would like if possible to conclude this session at 4:30 if it meets with your approval, and during the next 3 hours develop the next 3 subjects: Try to establish the status of our present knowledge of the disease, the direction in which research is presently progressing, and to outline the direction in which we believe it ought to go, and finally the financing of research, care of patients, and so on. So with all of that as the subject of discussion for the next 3 hours, we will all try to adhere strictly to the point and to make our remarks as quickly as possible.

We will begin with item V on the agenda, What Is Known Medically About This Disease Today, and Dr. Paul will begin the discussion.

STATEMENT OF DR. JOHN R. PAUL, YALE UNIVERSITY SCHOOL OF MEDICINE, NEW HAVEN, CONN.—Resumed

Dr. PAUL. This will be an impromptu and somewhat arbitrary discussion of a large and controversial subject. The ideas that I will present are essentially my own, but I think many of them have the support of general recommendations in committee. Nevertheless, I do want to emphasize that poliomyelitis is a disease full of pitfalls, that there is much that is not known, and in attempting to deal with it arbitrarily one has to simplify the situation almost too much.

Poliomyelitis, as most of us know it today, is a highly infectious disease due to a virus to which many references have already been made this morning. Fortunately, only a small fraction of those who become infected with this virus sustain paralysis. It is difficult to cite exact figures, but they have been given as 1 in 50 or 1 in 100 or even greater.

The medical profession has come to look at paralysis as what we call the complication of a rather common disease, fortunately the rather uncommon complication of a common disease.

Mention has been made of the properties of this virus. For a long time the views was difficult to work with because the only animals we could work with were monkeys and they were hard to come by. However, with the achievement of Dr. Enders, our ability to go ahead has been greatly increased.

Many people today in all sorts of communities come to you and say, "The doctors do not know much about it, do they, and they do not even know the causes of it?" That, I think, is not correct. There is a great deal known about the disease. The two major questions are how to cure it and how to prevent it, and the answers to those questions are not known at this time.

The next aspect of this disease that comes to our mind is how it is spread, and I think the balance of opinion is that it spreads, as many other so-called contagious diseases spread, from one infected person to another. This is very difficult for many people to understand because, unlike measles where you have an obvious sign of the disease in the form of a rash on the skin, fever, and so on, in poliomyelitis there are people who have this disease without showing external evidences thereof. Much of the mystery about the spread of this disease disappears when you realize there are many people infected with the poliomyelitis virus who have the capacity to spread the disease from one person to another.

This, of course, accounts for the reason why most of us when we reach adult life are immune to the disease. We have had it. The reason poliomyelitis is mostly a children's disease is the same as in the case of measles. In other words, in juvenile life, once having been infected with the disease, we develop a lifelong immunity and fortunately do not get it again in adult life. The same is true with some modifications, of poliomyelitis, and the age distribution of the cases in various parts of the world is a good indication of the degree of immunity which exists. This is a very important point because most of our discussions today are going to lead in the direction of how the disease can be prevented, and immunity is the keynote of that whole subject of prevention.

We might mention a few things as to how the virus enters the body. That has also been mentioned before. The subject is a little controversial. There are 2 or 3 points of view. I would say the balance of opinion today indicates the virus enters the body through the mouth. Whether or not it penetrates from the mouth directly into the central nervous system through nerves, or whether it goes to other organs in the body, is not altogether clear, but it is clear that it soon enters the blood stream and from there can pass to various parts of the body. That is why there is hope of preventing this if the virus can be kept out of the blood stream by raising the antibody content, as has been mentioned. I would not say that is the only way a person can get

poliomyelitis. That the virus can enter the body through a break in skin is also a possibility.

That it spreads from person to person is another point it is hard to say is true 100 percent. That certain contaminated objects could conceivably spread the virus is possible. I would think the spreading by way of objects would be in the minority. I am speaking now of contaminated food, milk, and so forth. The number of proven instances of spreading the disease through those objects is extremely small, relatively speaking.

The newer points that have come to our attention in the last few years, and which Dr. Sabin has already emphasized are, first, that it would seem the environment in which the individual is brought up has a distinct bearing on the age at which one gets poliomyelitis. He has called attention to the fact that individuals who are underprivileged and brought up under poor economic circumstances, as well as individuals in the tropics, are apt to get it at a younger age, and the chance of developing paralysis at a younger age is less per case than at an older age.

I would like to say a word about the clinical factor of this disease. That is a term a doctor uses in describing what an individual has in the way of signs or symptoms when he acquires a given disease. We have already mentioned the fact that in most instances a polio patient has fever, the fever lasting only a day or two, and has symptoms of vomiting, headache, and listlessness. In the small percentage of cases in which the disease goes on to what we call the major illness, there is involvement of the central nervous system, that is, of the brain and spinal cord. In those instances the patient again has fever, vomiting, listlessness, often accompanied by a stiff back, frequently by pain in the limbs, and in the severe cases paralysis occurs. This is the so-called spinal type of the disease. The paralysis usually affects the legs, but other limbs are involved—the arms, the back, muscles of respiration and of the face.

In the most severe form of the disease the part of the spinal cord involved is that closest to the brain and the muscles that enable us to swallow and talk and breathe are involved. That is called the bulbar type of poliomyelitis, which is the most fatal form.

Usually the fever is not particularly of long duration, seldom lasting more than 5 to 7 or 8 days, but during that time a great deal of damage can occur in the spinal cord. The nerve cells, if severely or irrevocably damaged, cannot be repaired and that, of course, is the reason why so-called flaccid paralysis results.

We have come quickly to why we have emphasized these points, and I should mention how they influence our thinking in the attempt the world is making above all things to find out how this disease can be prevented. It can be prevented in two ways. One possible way is to rid the community of the virus, which would be extremely difficult. The other is to bolster human immunity to a point where we would have the benefit of exposure and the corollary of infection to and development of antibodies to the disease.

To rid the community of the virus would be, as many people appreciate, an impractical effort, and it is questionable whether the result would be what we want. That does not mean, of course, that there should be no attempt to isolate infected people and to prevent unnecessary exposure to the disease, because those measures are put into prac-

tice at the time of epidemics and in the summer when the disease is spread in the effort to protect families in a community who know that in the same block in which they live there is a known case and therefore the possibility of spreading it in a community exists. But I should mention that the greatest quantity of efforts by isolation and quarantine have not proven very successful; yet it is still worth while following them when the incidence of the disease is high, that is, during epidemics.

It has been shown that in patients who have the mild form of the disease and whose future life, you might say, is hanging in the balance as to whether it might go on to the more severe form, during that crucial period in the disease, it has been found important to spare and protect the patient from certain procedures, among which we might mention tonsillectomy, which is not to be taken lightly during a poliomyelitis epidemic. Other things that fall into that category, such as fatigue factors, trauma, and stress, must all be considered to prevent the actual incidence of paralysis in an individual who may be fortunate enough to be suffering from the nonparalytic form of the disease. These, therefore, are certain things that every doctor should know about the disease in an attempt to answer the questions by his patients as to how it can be controlled.

The question of bolstering the immunity of children is perhaps one of the most important subjects to go into today. I will not go into that. I am trying to give you the background of the so-called clinical factors. One is the use of gamma globulin as a means of giving what we call a passive immunity, and another is the so-called active immunity, in which, by injecting certain substances into the susceptible individual, he can make his own antibodies which will perhaps guard him through life.

These are but a few of the points in regard to this disease. I have not touched upon the fact that poliomyelitis is a summer disease, and that is one of the mysteries about it. One of two things seems to happen in warm weather. Either the virus finds itself distributed in a fashion which is much more efficient in the summertime or individuals in the summertime become much more susceptible, that is, less resistant. I, for one, rather favor the first theory.

The other points that might be mentioned are that although the mouth is the usual place where the virus enters the body, the question of were it leaves the body is important if you are going to be concerned with its spread. The majority of opinion has led us to believe that during the first week of the disease and during the incubation period, which lasts from 3 to 20 days, the virus can be found in the throat, and probably is spread by young children harboring it in that location; but for a longer period of time it seems to be in the intestinal tract, and in human stools it can be detected for periods from 1 to 12 weeks, not only in patients with paralysis but in patients with the mild form of the disease.

I think that is about as much as I will try to cover. Again I want to emphasize these are points that have to do with the medical knowledge of this disease on which we can attempt to base the program of prevention which seems now to be in the offing.

Dr. SABIN. Thank you very much, Dr. Paul. May I now call on Dr. Hammon to add his comments on the same subject, and then per-

haps we might have a few other expressions before turning it over to you, Mr. Chairman, for your own questions.

Dr. HAMMON. I do not think I need to add much. Dr. Paul's review has been quite complete as to the most important origins of knowledge in regard to poliomyelitis. As he said, he did not cover the entire subject. The things he omitted I think are those of relatively minor importance. I will not try to fill in all those omissions. I do not think this is the proper place in the program for pointing out what we do not know about poliomyelitis. There are many things we do not know.

I think I will add only one thing to what Dr. Paul said, and that pertains in particular to the work I have been doing in the last year or two. I think one bit of information to be gleaned from the studies of gamma globulin in human beings, which is important at this time, particularly in view of the subsequent discussion on vaccinations, is that we now have some information as to the approximate level of antibody necessary to protect against the clinical disease. We found that the protective effects of gamma globulin lasted for several weeks, at least 4 or 5 weeks, and possibly 6 or 7. The end point could not be determined accurately.

Certainly, in those later cases, although the person was still protected against paralysis, no antibody, by our present means of detection, could be observed. So the level must be very, very low, and I think that has some importance from the standpoint of when we seek to protect a person by vaccination, because we have some concept now of what level of antibody is necessary rather than a concept of a great deal of antibodies or such a level that a person develops as a result of actually having the infection. The concept now is that a very small amount—a trace so far as our methods of detection are concerned—is an adequate amount, and it gives some type of level to aim for in future studies.

Dr. SABIN. Thank you, Dr. Hammon.

I would like to take a moment to recapitulate what has been said in the form of questions.

Where in nature is the virus which causes infantile paralysis? I think there is no disagreement now that it is present only in human beings who are infected with it or in those living things of nature which can eat human excretion. Dr. Paul has pointed out that because filth flies eat human excreta they may play a role, but it has not been possible to show that control of the insect would in any way control the disease, because the main source of the virus is the human being.

The next most important question is why is it that at least 80 percent of all the diagnosable poliomyelitis—paralytic poliomyelitis—occurs during only about one-third of the year—the summer months. The answer to that must remain in the field of future investigation, because we cannot yet with any certainty say why, except that the studies in Dr. Paul's own department and the studies of other individuals show that, for instance, during the summer months most of the dissemination of the virus takes place; that it is during the summer months that children acquire immunity without getting infection, and that is based on studies carried out by Dr. Turner at Baltimore. So we already have evidence that there is something during those summer months and fall months that aids the great dissemination of the virus.

Whether it is due to the fact that it can more readily multiply in human beings during that time or whether there are outside factors that contribute to its dissemination is something we must answer in the future. If poliomyelitis would occur throughout the year with the same incidence that it occurs during the summer and fall months, it would hardly be a significant question at all.

The next question is, Why is it that so many people become infected and so few become paralyzed? One could discuss a great many different findings which would not be easy for you to understand because they have not crystallized, and they, too, with the newer tools will be subject to future investigation.

The next question is, Do we now have the tools at hand for specific diagnosis—that is, which case is poliomyelitis and which case is not—except for clinical impressions? Up until a few years ago we could say that we did not, but now there are methods available which would make it possible to diagnose poliomyelitis within at least a week and sometimes within a few days after the patient is admitted to the hospital. But I would like to call to your attention the fact that while those methods have been worked out on a laboratory scale, the developmental work that needs to be done in order to make them useful for the physicians of the country and the world has not yet been done, and unless something is done in a practical developmental way that information may very well lie dormant in the laboratory and not become useful.

Next we go on to the question of whether or not a person who becomes paralyzed need necessarily have permanent paralysis, and the factors that determine whether or not he shall remain paralyzed or not. Dr. Paul has mentioned particularly the role of fatigue and exercise, but a great deal more work in the future may be able to show us what, if anything, can be done during the period of the earliest moments of the infection when the patient has only just the fever, and to be able to prevent him from getting the disease after he has already acquired the infection.

Dr. PAUL. You mean paralysis.

Dr. SABIN. No; I mean the infection. Disease, to me, is paralysis and infection is something that we know about. The disease is something that makes a person merely sick, but I stand corrected. That, in a general way, is the status of our knowledge at the present time with regard to poliomyelitis.

Now, we would like to have questions from you. Most of the time we are accustomed to talking to ourselves and we sometimes think we speak clearly and that it should be understood by anyone else, but it is surprising to find that we are not always understood. Mr. Chairman, may I turn it over to you for questions?

The CHAIRMAN. Are there any questions?

Mr. THORNBERRY. There was one point on which I am not completely clear and that is when you say that the majority opinion is that the virus is communicated from person to person. Is it person to person by ordinary contact?

Dr. SABIN. I am very glad, Mr. Thornberry, you asked that question because that is one of the perennial questions and arguments that we get into, and there are many things that Dr. Paul said, for example,

and some, probably, which Dr. Hammon said, which probably brings up this question, and that is just the question that hits the nail right on the head. It is not enough to say that it is communicated from person to person, but we have got to draw a picture as to how it comes out and how it gets in, and so on.

Dr. Paul, you are on the spot and this is a good place to make it clear—at least to the extent of our present knowledge.

Dr. PAUL. As I understand the public-health language in this respect, there are two forms of so-called contact. One is the so-called droplet infection in which an individual coughing or sneezing or having some type of irritation of the respiratory tract can expel into the air particles or droplets which contain the agent causing the disease. It is uniformly thought that influenza, the common cold, and perhaps measles are transmitted in that form of contact. But that is not the only way. In order to answer your question properly, Mr. Thornberry, I must say we should have experiments that we do not have, but it has been shown that this type of infection which may be present in the mouth—the virus may be present in the mouth and may be present in the intestinal tract—can quickly contaminate a whole child. It has been shown that that is true of other infections which are more easily studied in this fashion and that a child wrestling with other children on the beach and coming in contact by other ordinary forms, such as shaking hands and all sorts of intimate contacts, is a perfectly reasonable medium through which the virus can be transmitted.

I, for one, am not very enthusiastic about the droplet infection in poliomyelitis. There are others who are and I do not want to take up the time here arguing the point.

Dr. SABIN. I wonder if I may add a few remarks at this point.

What we know for certain is that the virus is there and at a certain time of infection is in the throat—in the back of the throat—and we also know for certain that it comes out through the stools, but there is a difference of opinion about whether the virus that is present in the back of the throat ever comes out in significant ways to contaminate the hands, to contaminate the atmosphere, so that people sitting in a church or in a movie can become infected one from the other without touching each other or without handling any article in common. My own opinion is that at the present time there is no evidence to prove that it is so. Other people believe that perhaps it is, but further work should provide an answer to the question with the newer methods we have available.

Secondly, what is definite is that large amounts of the virus comes out in the bowel discharge of human beings, and there are many infectious agents that are known to be so discharged from the human being, and my own feeling is that the numerous ways in which other infectious agents are excreted in the stools and can be disseminated from person to person also applies to poliomyelitis.

If you have a carrier who puts out a tremendous amount of virus—some may put out very little and some may put out a great deal—if he puts out a lot and he has just had a bowel movement and has not been careful in cleaning his hands—for instance, if it is a mother and she has put her hands all over the meal which she has prepared for others, that is as good a way to disseminate it by contact as any other.

Precisely which is the most important may be difficult to tell. One method may be most important under one set of circumstances and another under another. I find it most useful to think that the most important thing about it is that the viruses go out in human stools and excretions or secretions, and which ever way they go out would be in large concentrations. More work should be done on this, because I mentioned dosage here about which we know very little.

The work in dysentery has proved that it is not only important to know that a person is putting out a typhoid bacillus, but it is important to know whether he is putting out 1 million or 10 million, and in poliomyelitis we still do not know that. The quantitative studies are still in the very beginning, and additional work still needs to be done. These studies should give us the greater understanding of the disease that we need for ultimate control.

Mr. THORNBERRY. Let me ask you this question: Is it the majority opinion that it is a respiratory infection or an intestinal infection?

Dr. SABIN. Well, I think the statement which Dr. Van Riper read and the statement that Dr. Paul has just made and the comments that Dr. Hammon has made on that are that in the majority of instances, because of where the virus is in nature, it is transmitted by way of the mouth. I will tell you where a little difficulty comes in in that connection. Some people will say that the back of the throat is part of the respiratory tract and others will say it is part of the digestive tract, but I think you will get much more agreement on the question that it goes in by way of the mouth. The important thing is this: If it goes in by way of the mouth, you have got to touch somebody or eat something that has been touched by somebody. The other means is that you can contract it at a school, at a beach, at a movie, at a great public gathering and get the infection whether or not you touch anything but merely by breathing in the air. When we finally get the last word on that, you will not have public-health proclamations, when there is a little epidemic, shutting down the churches and movies, prohibiting gatherings at football games and all sorts of things which, at least in the minds of some of us, have no good foundation now. But, as I said, until we can nail the lid down, this thing will go on.

Dr. HAMMON. May I add something at that point? There is one thing that has not been pointed out, and that is that some experimental laboratory work has gone on which gives, I think, considerable information that applies here, and that is that we have not been able to find any set method by which poliomyelitis can be dried and keep its life. When it is dried, it rapidly dies, while if kept moist, as can be done in feces, and if kept in secretion or if kept in plain water or something like that, it can be kept alive at room temperature for long periods of time. That might help also in our concept of how it is transmitted. There are very few who believe today that the virus particle so disseminated is free from mucus or free from feces and that it is entirely dry and can be wafted in the air. It is highly unlikely that the virus in a form where it would be suspended in the air would remain alive, and therefore we do not believe it is airborne and that just breathing is a possible source. We think more that moist-type secretions or excretions would probably be the source. So the child sitting in a theater is not going to be infected by breathing air but more likely would be infected as a result of that common box of popcorn or bag of peanuts that the child sitting next to him is

digging his fingers in when they are contaminated with the virus or with secretions from his mouth and putting his fingers on the object he is eating, and then the next child reaches in and puts that popcorn or peanuts in his mouth.

We think those are the more likely methods of passing it from one child to another. We have observed 2-year-old and 3-year-olds and 4-year-olds playing together and have seen them frequently put their fingers in their own mouths and in the mouths of the other children, and objects being exchanged from one mouth to the other, and that would seem a reasonable method of transmitting the virus.

I happen to be of the opinion that if the virus is in the back of the throat, it probably is in the discharge that comes from the mouth, and therefore when it is moist discharge, that could be a good method of passing it from person to person.

Children today in this country are relatively clean in the rectal area, and although there are feces inside a diaper to a large degree, the gross contamination from that would maybe be a little less likely in this country than in the countries of poor sanitation and poor hygiene where there are children with no covering of their anal openings and where defecation is promiscuous and where it can readily get back into food and where diarrhea and dysentery are frequent. There is an indication that that would be one of the methods of transmitting it.

We are faced with the same situation in regard to the secretions of the throat as we were 50 or 100 years ago. We still use a handkerchief and put it back in our pocket. But, of course, in regard to toilet paper, we do not put that in our pockets. But we could receive contamination from our handkerchiefs. It is my impression that possibly today in the better economic groups of people with good training and hygiene practices, contamination and access to the virus could be from the throat, but those are personal opinions and we have no measurement as to those things yet. Dr. Sabin and Dr. Paul have a right to their opinions and I have a right to mine. We agree, I think, entirely, however, that there are two sources of the virus, but which source of contact is more important we do not know.

Mr. THORNBERRY. Now, adding a little bit more to my question, why is it that you have eliminated carriers by insects such as the fly?

Dr. HAMMON. We have not eliminated that completely. I think statements have been made to the effect that we think it is relatively unimportant and quite unimportant. Today we have better sanitation in our communities, and there are not very many opportunities for these insects to come in contact with human feces, and the possibility that they could get upon our food after having just previously been on human feces is very low, and therefore the likelihood of that occurring is slight. But in certain communities where feces are all about in the bushes and the grass, and around the house where there are millions of flies with no fly control and no sanitation at all and no cutting down of the breeding places of the flies, and there are millions of flies and they are swarming all over food and our fingers, and so forth, I would be unwilling to say it might not be of some importance.

Dr. SABIN. I would like to add to this testimony that the only thing that has been proved is that if you go in after an epidemic has been established and try to do everything to cut down on the number of flies, it will not have much effect on the epidemic. That is as much as

we know. To what extent it may play a role in certain places in starting an epidemic we do not know, but at least we know from the practical point of view that if you go in after you have recognized an epidemic and try to rid the area of flies you will not get very far.

Dr. PAUL. I think we know a little more than that, if you want to use a positive statement. We know epidemics of poliomyelitis have existed where no flies were present, such as the northern coast of Alaska, in a season when there were no flies. We also know that if the virus is actually fed to flies one cannot demonstrate multiplication within the insect, as one does in yellow fever with the yellow-fever virus or in malaria with the mosquito. So one can at least say that flies are not essential and also that the agent does not multiply in them as it does in certain diseases such as yellow fever and malaria, where the insect plays a most essential role in the spread of the disease. However, I would hesitate to say in a country which is completely overblown with flies, such as some of the middle-eastern countries, where you see children with flies all over their faces at all times of the day, that that might not enter into the story there.

Dr. SABIN. I have information here to the effect that you would like to get direct testimony from people who still have to talk by 3 o'clock, and, with your permission, Mr. Chairman, we will move along, if there are no other questions on this subject.

Mr. HESELTON. I would like to ask one question at this point. You used the word "epidemic," and others have used it, but I do not think anyone has defined it. Is there any standard definition as to the number of cases there has to be?

Dr. SABIN. I believe Dr. Paul is able to answer that question.

Dr. PAUL. Very crudely, it represents an increase in the ordinary prevalence of a disease by 2 or 3 times. Or, if you want the broadest type of an epidemic situation, every winter we have, let us say, a given amount of this disease, but when it is prevalent more than 2 or 3 times, that is the best definition. It comes from the words "epi" and "demus," meaning "on the people," and all that means, if you want to use another principle, is a blight on the people.

Dr. SABIN. It is a little more specific than that for practical purposes. For practical purposes, in poliomyelitis, if a community during the course of a year has had 20 reported cases per 100,000 of the population, it has generally come to be regarded as an area in which an epidemic has occurred. Some epidemics are no more than that, and others are as high as 200 or 500 or 1,000 per 100,000 population. The reason for that is that the usual average incidence of the disease may range anywhere from 2 to 5 per 100,000. When I speak of diseases here, I mean those recognizable and diagnosable infections. That is very arbitrary, but I think that has been selected as the guide.

The CHAIRMAN. Is the disease more prevalent in a temperate zone such as ours or in a warmer climate such as that of Central America?

Dr. SABIN. The recognizable disease is more prevalent in the temperate United States than in Central America, but epidemics of poliomyelitis have occurred in Mexico, but they do not occur, apparently, as frequently.

The CHAIRMAN. It seems to me to be more prevalent here in warm weather, and I wonder how you would account for the fact that you would have it here and not have it there.

Dr. SABIN. We must go back to repeat the most important thing about poliomyelitis, and that is, where the infection is spread most extensively, the recognizable disease does not necessarily occur most extensively. That is the paradox of poliomyelitis. So, while in Central America and other subtropical areas and tropical areas there may indeed be greater spread of the infection, for some reason the total incidence of recognizable disease is not as high. So it appears paradoxical, but in effect it is not.

Mr. HESELTON. I think it was suggested by a witness at a previous hearing that it might be because there are many who had had what you call a light case and have developed an immunity to the disease.

Dr. SABIN. You might say the reason that many more people have had the infection and developed an immunity and have done so early in life is because of the very fact that the infection is disseminated so extensively, which has given them an opportunity to acquire it before they are 3 years old and thus develop an immunity.

Studies which we carried on immediately after the war in China, Japan, and elsewhere have shown that children in those areas may acquire a 90- or 100-percent level of immunity by the time they are almost 3 years of age. In some of the areas that Dr. Paul has studied it was even earlier, and in some of the areas which Dr. Hammon has studied it was even earlier. I made a comparative study with children in Cincinnati, and it took the youngsters up to the age of 10 to 14 to reach that same level of immunity of those children in crowded areas which I mentioned such as China, Japan, and so forth.

Let me let this out of the bag so you people will understand. I have a little note that says the chairman plans to catch a 3 p. m. plane; so try and go along with your other witnesses. If we may do that, I would like very much for the chairman to hear the people who have not yet had an opportunity to speak. So may I suggest that the people who have not yet had an opportunity to speak divide up the 35 minutes in a manner so that you can hear them all.

The CHAIRMAN. I will leave someone in charge when I leave the committee room.

Dr. SABIN. Yes. But I understand you would like to hear what they have to say.

The CHAIRMAN. All right. You may proceed.

Dr. SABIN. We come to item 6, on which a great deal has already been said, namely, what are the private and public foundations doing in the poliomyelitis field. Dr. Van Riper has read the report of the national foundation, but I think Mr. Barrows knows about the financial aspects of getting the money from the public and using it, and he can tell us a little about the foundation and the way that money is being utilized and what the prospects are for the future.

Mr. Barrows, will you give us a 5-minute discussion on that?

The CHAIRMAN. Do not limit yourself to 5 minutes unless you can say everything you know in 5 minutes, and I doubt that.

Mr. BARROWS. That would be a damaging admission.

Well, of course, when you talk about finances, particularly right on the heels of the dramatic side of any disease, and that is the research and the medical practices that are akin to it, you find it is a little bit drab to talk about money. On the other hand, I think there is quite a bit of drama connected with the support of the national foundation and in the doing of their job, as we have seen from

the interest of the public itself. Certainly, as more informaton has been made available to the public and as progress has been made, the public has responded correspondingly with a great deal of interest. I think since the beginning of the national foundation until the March of Dimes of this year, the public has responded with some $250 million of public support. All of the money that the national foundation has received for its work has come from the public. We have had no other source of income.

Dr. Van Riper in making his report covered the salient areas in which some of this money has been spent. We have a three-pronged program, which covers patient care, the helping of those people who need supplemental financial assistance; then we have the research that is carried on by the national foundation in virology and epidemiology and research in the prevention and aftereffects; and professional education which is in the form of fellowships and scholarships and in some instances in giving refresher courses to physicians and others. That is an effort which was explained in Dr. Van Riper's remarks, which is to make available more people so that they could be trained to carry on both the therapeutic work and other advancements that have been devised as well as to train people to do greater and more research.

With regard to the amount of money that has been spent to date for these three programs, I can give you the total amount and then some idea of the early expenditures in those same categories.

Through 1952, of the amount that has been available to the national foundation, some $145 million has been spent in what we call patient care, and we anticipate during 1953 that this may reach somewhere around $170 million total. In 1952 the amount consumed or amount used in patient care was something around $24 million. Our early estimates seem to indicate it might go as much as $26 million in 1953.

Now, in the matter of research, from 1938 to 1952 some $18.1 million was spent in all of the research, and just to give you some idea of the proportion of it, I understand about one-fourth of that amount has gone into the aftereffects—that is, research on the aftereffects—and the bulk of it has gone toward the virology and epidemiology aspects. We anticipate that that will go up to something around $21 million, totally, after this year has gone by. There will be some $4 million required for research this year alone.

In the last program of the foundation, which is the professional education, from 1938 to 1952 there has been spent some $16.4 million, and by the end of 1953 that may reach $18 or $19 million.

Those are very general figures, and I would prefer perhaps to continue any discussion of the financial problems of the national foundation on the basis of your interest. But that is a very broad picture of the financial position of the foundation.

The CHAIRMAN. How many individuals are directly interested in carrying on the research program?

Mr. BARROWS. I should have covered that, Mr. Chairman, because I think one of the strengths of the foundation has been its very broad base of giving. We find that all kinds and all manner of people will give to the foundation because they feel that their little contributions help considerably, and we judge that automatically on the basis of receipts as they are sent to us by our chapters, and there may be as

many as 70 million people in the course of a year that give some funds in some amount to the national foundation.

Dr. SABIN. That was not the question as I understood it. I would like to have the answer to that myself.

The CHAIRMAN. I was interested in that information he has also given, but the question that I asked was how many people in your organization are directly interested in participating in the research program. I do not mean overall, as to how many are in administrative work and so forth, but how many are directly participating in the research program.

Mr. BARROWS. Dr. Van Riper, could you furnish that information?

Dr. VAN RIPER. Mr. Chairman, while we spend money on our research program, the national foundation does not of itself conduct any research. We have no staff member who is actually doing work in a laboratory. Grants-in-aid are made to institutions irrespective of their geographical locations. They are made by a committee whose members represent various fields of science who meet semiannually and review applications that come from men at this table. We have Dr. Sabin and Dr. Paul and Dr. Hammon, who are currently working under grants-in-aid from the national foundation in support of programs which they have outlined. The committee recommends that such aid be given or not be given, and then actually the board of trustees awards the money through grants which are made for various periods of time—12 months, 18 months—and some of them are what we call long-term grants that go for a period of 5 years and may be renewed at the request of the applicant and the recommendation of the advisory committee. I would say at the present time there are probably somewhere in the neighborhood of 40 different individual research grants under the support of the foundation in operation at this minute.

Mr. HESELTON. I believe you have a laboratory for the production of gamma globulin.

Dr. VAN RIPER. That is not a laboratory. The national foundation is assisting the Armour Laboratory in obtaining some fractionating equipment merely to increase their output of gamma globulin.

Mr. HESELTON. That is the Armour Laboratory?

Dr. VAN RIPER. Yes. And I believe the amount of that assistance was about $450,000 worth of equipment.

Mr. HESELTON. Would you or Dr. Sabin describe briefly how the foundation appraises its awards of fellowships and scholarships and other types of grants?

Dr. SABIN. Any of the grants, whether they be educational or for research, I think are stimulated in 1 of 2 ways. We have from time to time had what we call roundtable conferences—in fact, there is one scheduled for November of this year in physiology—and to that conference are invited members of faculties of schools of medicine, individuals who are working on problems as regards the physiology of respiration and circulation. They are invited to that conference, and it will be a 2-day conference in which they will discuss the problems that are present in the aftercare of patients recovering from paralytic poliomyelitis and explore projects that might be worthy of support.

Now, from that conference may come a request from a university department of physiology or department of internal medicine, and

that comes in on a prescribed application form in which the individual outlines what he wants to do, how he wants to do it, how long he thinks it will take him to do it, and what he feels will be the results of that investigation. Now, naturally he cannot be sure of the results, or it would not be worthy of investigation if we knew the results.

Our committees review this application semiannually and recommend what should be done in regard to it, and in April they determine whether or not the question has been answered or maybe it has been answered by someone and it should be checked by another laboratory and so on. They also review the competency of the individual who is asking for the money and determine whether or not it is such that one would feel he could answer that question and whether the question is of sufficient importance to be worthy of support and whether there is something that we feel could be done within a reasonable time or is it something that is going to take so long that we might feel we could not support it.

Then those committees recommend that the foundation grant the funds or not grant the funds, and then those are in turn taken to the board of trustees of the foundation, and that board is made up of laymen. There are no physicians on that board, and they actually award the grants and they are paid to the universities for the year, if it is a grant covering a year; or if it is more than a 1-year grant, then the first year is paid and the other money is held in trust, in effect, so that at the end of the first year the individual grantee knows he has money to continue his program, if the original request was for more than a 1-year period.

Mr. HESELTON. Is the research in this field or these fields being carried on by any other organization?

Dr. VAN RIPER. Well, the Public Health Service is carrying on some research, and I am sure there is some research certainly going on either supported by other foundations or supported by private individuals, and certainly some research is going on supported by the universities—by schools of medicine—from funds available from endowments and so on.

Mr. HESELTON. What means do you have of insuring that the results of the research will be made largely available? I suppose ordinarily any research results would naturally become public property if they published a statement about it, but is there any central group that insures that such results will be made available?

Dr. VAN RIPER. Well, of course, the foundation cannot publicize an individual research work until such time as the individual researcher reports it himself, and that is usually made before some scientific group. Then, of course, it becomes public knowledge. Beyond that, we are cooperating with the agencies in the Federal Government who are conducting research along this or related lines and exchange that information so that there is one agency in Washington that any individual could go to and find out who are the individuals or what institutions are interested in a particular type of research.

Mr. HESELTON. You say there is one such agency. Is that the National Science Foundation?

Dr. VAN RIPER. No. It is actually conducted by the Public Health Service.

Dr. PRICE. It is located under the National Research Council at the present time.

Dr. VAN RIPER. It has been kicked around down here.

Dr. PRICE. It was originally set up under the Public Health Service and after a few years was transferred to the National Research Council where it is administered. It is called the Medical Sciences Information Exchange.

Mr. HESELTON. Mr. Barrows, I believe you said there was about $145 million spent for patient care since the fund was started.

Mr. BARROWS. Since 1938; yes, sir.

Mr. HESELTON. What has been the total contribution to the fund over that period? Do you have that information?

Mr. BARROWS. Yes. Very close to $250 million.

Mr. HESELTON. I suppose the level of the amount spent would vary from year to year.

Mr. BARROWS. Actually, that is what I meant when I said that the public interest had increased with the progress, because every year we have been given a little bit more. I would say this, that the national foundation has never attempted to set a quota, as many voluntary associations do. Naturally, we try to anticipate from what we know what the succeeding year is going to require, but we go entirely on the basis of the funds that are given to the foundation for operation.

Mr. HESELTON. Have you any information as to what the average patient care cost is?

Mr. BARROWS. That was included in your report, Dr. Van Riper, as I recall it.

Dr. VAN RIPER. $629 was the average cost of care for a period of January through May of 1953. When we are talking about averages of costs, we must remember that there is the individual patient who has a very mild attack of the disease and may be in the hospital for only a week, and then we have the patient who has respiratory involvement and who may require 3 nurses or such nurses as are necessary and the use of the respirator and all the other attendants that go with it, and that may run to $60 or $70 a day. So to average those out gives you a very incomplete picture.

Mr. HESELTON. How does the fund determine what shall be paid?

Dr. VAN RIPER. Each chapter operates more or less as a unit, but if an individual is hospitalized or needs assistance, the family or some responsible member of the family is directed to that chapter and they sit down and discuss with the chapter what they reasonably feel they can pay toward the patient's cost of treatment, and then the chapter or the foundation subsidizes up to the total cost of care. If it is polio insurance, it will cover the full cost. It may be Blue Cross or some other type of insurance which may pay all or may pay part of it. We have never felt that an individual asking for financial aid from a chapter should sign a pauper's oath that he is destitute, but I like to say that this patient-care fund is like a trust fund. When people give a dime or a dollar to the fund, they hope they will never have to call on it, but if they are in such circumstances that they need financial help, they go and sit down and discuss honestly what they can pay with these members of the chapter, who are actually their neighbors. The family may feel they can pay the full cost when a patient goes first to the hospital, but 3 days later the patient could be in a respirator and require much more additional attention, and consequently financial adjustments between the family and the chapter are made.

The CHAIRMAN. As I understand the figures that you have submitted, Mr. Barrows, you collected $250 million since 1938.

Mr. BARROWS. Since 1938 and that includes the March of Dimes this year.

The CHAIRMAN. Patient care has required an expenditure of approximately $145 million?

Mr. BARROWS. That is only through 1952, Mr. Chairman, and when you add to that our anticipated expenditure this year, it comes very close to $170 million.

The CHAIRMAN. $170 million?

Mr. BARROWS. Yes, sir. You see, $145 million was through 1952.

The CHAIRMAN. And $20 million has been spent on research?

Mr. BARROWS. Around $21 million through 1953.

The CHAIRMAN. This would indicate that about, I would say, 8 percent has been spent for research in recent years, and does that cover the approximate research figures for the last 5 years?

Mr. BARROWS. Our report of 1952 indicates 69 percent for patient care, and for research and professional education about 18.7 percent. That was in the year 1952, which was, of course, the heaviest year we have experienced.

The CHAIRMAN. Are there any further questions, gentlemen?

You may proceed, Doctor.

Dr. SABIN. I would like to call on Dr. Haas to speak on the position of the Public Health Service in this field.

STATEMENT OF DR. VICTOR H. HAAS, DIRECTOR OF THE NATIONAL MICROBIOLOGICAL INSTITUTE, PUBLIC HEALTH SERVICE, WASHINGTON, D. C.

Dr. HAAS. Mr. Chairman and gentlemen, the chairman brought out this morning two areas of interest in relation to the activities of the Public Health Service, particularly the National Institutes of Health, relating to poliomyelitis.

With your permission, I would like to address my remarks to those two broad areas.

The first had to do with what is going on and what has gone on in research in the National Institutes of Health at Bethesda. Some of the contributions made by my predecessors and colleagues there have been referred to during previous testimony today, so I would like now to bring some of them together and emphasize them here.

From almost the beginning of the century, scientists in the Public Health Service have been interested in this disease, poliomyelitis, and much of the early development in epidemiology followed the very clear presentation of the problem by Dr. Frost about 1910.

As you can see from what has been said today, Dr. Frost did not give us answers. We still do not have many of the answers. He did, however, perform a great service and his successors extended it in helping to clarify and crystallize the problems which have been so well stated by my colleagues on the panel earlier.

As time went on another highlight was the attempt to prevent polio by the spraying of certain chemical compounds into the nose. That, too, was alluded to briefly this morning; tannic acid first and subsequently picric acid were proposed for this use. This took place nearly

20 years ago. In the light of the scientific knowledge of that day it appeared to be very promising and hopeful.

I happened to be a very young recruit to the scientific staff of the National Institutes of Health in those days, and I remember the feeling of optimism which prevailed among all of us; the hope that here was a very simple and logical approach to this problem. Unfortunately, that hope was not to materialize, but at any rate at that time for a while it seemed like a real step forward.

As years went on the difficulties in polio research were more apparent than the progress. Then in 1939 came the transmission of a strain of polio virus to the cotton rat and the white mouse, referred to again in previous testimony today. I believe that accomplishment did a great deal to break the inertia which had fallen upon polio researchers because of the many difficulties inherent in working with this virus in the laboratory.

Prior to that time one could work only in the monkey, and many research workers found it impossible to support the type of establishment required to handle monkeys, and many became discouraged about ever getting ahead because of those difficulties.

I feel that Dr. Armstrong's accomplishment in transmitting the Lansing strain of virus to those small laboratory rodents was one of the big steps forward in stimulating the interest and the renewed participation of laboratory workers throughout the country in polio research.

This scientific development, fortunately, took place at about the time that a very important economic development occurred—namely, the birth of the National Foundation for Infantile Paralysis. So we had at that time an important scientific advance coupled with a new opportunity for scientists everywhere to get support for laboratory research in poliomyelitis.

Then in the last couple of years this accomplishment of Dr. Armstrong in transmitting the Lansing strain of virus to small rodents was succeeded by the transmission by other Public Health Service scientists of the two remaining strains of virus to the white mouse by a new method of inoculation directly into the spinal cord.

We have heard much today about the use of tissue culture in the growth of poliomyelitis virus and the importance of tissue culture in the production of a vaccine and in the development of diagnostic tools and epidemiological tools for the study of this disease.

I am sure that some of you will recall that one of the outstanding workers in tissue culture in the United States is Dr. Earle, of the National Institutes of Health, who for many years pioneered in the development of this research tool; so that while Dr. Earle himself did not participate in the research on poliomyelitis specifically, the things that he accumulated in the way of basic knowledge over many years have contributed greatly to this recent development in the specific field of poliomyelitis.

We have discussed vaccine here this morning, and it has been pointed out that the national foundation shortly intends or hopes to begin a study of the available vaccine to see whether it in fact will be effective in preventing poliomyelitis.

I would invite your attention to the fact that for 12 or 14 years the National Institutes of Health has conducted a study in the use of other vaccines, particularly that against whooping cough, which

has developed basic facts so that now we can look forward much more confidently to a large-scale test of vaccine than would have been the case had not all of this work—not in polio but in other fields—been done.

I believe the foundation investigators, when they actually go into the field with their vaccine, will profit greatly from the basic facts brought forth in the National Institutes of Health's studies of bygone years on the use of vaccines in human populations.

Last week I had the privilege of speaking before you in relation to the Biologics Control Act as it applied to the use of gamma globulin in poliomyelitis prevention. If vaccination is to be done, if vaccine is to be used in humans, we will be equally as concerned in respect to vaccine as we are now in respect to gamma globulin. It will be our responsibility to make certain that whatever vaccine is offered for use has some evidence of effectiveness and that it is safe for use in humans.

We are prepared to assume this responsibility. Our scientists during the past few years have anticipated that such a situation ultimately would develop, so that they are now preparing themselves to assume responsibility for making certain that whatever vaccines ultimately are to come will conform with the principles of safe and adequate biological products.

I believe that some of the things that I have said may illustrate a principle that advances in a given field of science do not always, or necessarily, depend upon research workers engaged in those specific fields. Advances of a basic nature, or advances in related but nonspecific fields, often are extremely important to the particular categorical field of interest, and in this connection I would like to emphasize the view that the Microbiological Institute which is responsible for research in infectious diseases in the National Institutes of Health at Bethesda is currently engaged in approximately 50 separate projects on infectious and parasitic diseases, many of which are of great national and international importance.

There was also an expression of interest this morning in our Clinical Center and what its relationship might be to polio. Perhaps I may illustrate that by a concrete example of current importance.

Last July there occurred in Rockville, Md., an unusual outbreak of an apparently infectious disease at a private mental-disease hospital, Chestnut Lodge Sanitarium. The people who became ill were nurses, and the disease in some respects resembled polio and in other respects it differed from polio. Up to the present time we do not know the specific identity of this disease and we have not isolated a causative agent.

Last week, after a period of quiescence, there were seven new cases in the same sanitarium. We admitted to our Clinical Center five of these patients for thorough clinical investigation, so that we might define as accurately as possible the nature of the illness in these people, and for concurrent laboratory investigation in the hope that in due time we may be able to narrow down the possibilities as to the etiological agent. Whether or not this disease may be polio, it is a disease which, at least to some people, was highly suggestive of polio and in which some of its aspects appear not to be polio. At any rate, our Clinical Center was open. The facilities were available and we admitted these patients and still have them for intensive study.

In summary I would like to emphasize once again the importance of fundamental research to polio, as to any categorical field, and to point this up I would like to read the concluding paragraph for emphasis of the statement which the Public Health Service has submitted for the record. The paragraph is as follows:

> The specific benefits to be derived from a broad approach to research problems are impossible to predict. From past experience, however, we know that new knowledge frequently finds unexpected application to problems far removed from the original area of investigation. The point which is worth emphasizing here is that the basic knowledge which we seek in critical research is essentially noncategorical. In our efforts to find answers to pressing problems, we must remember that imaginative science seldom reaches its full potentialities when support is inflexible and work restricted to rigidly specified problems. The record of history shows that tomorrow's practical results are almost always the progeny of today's free curiosity.

I would like to conclude by referring to a comment of Sir Isaac Newton on an occasion when he was complimented for his farseeing work. He said, "If I have seen far it is because I have stood on the shoulders of giants."

That, I think, is his way of expressing the idea of the importance of fundamental research.

The CHAIRMAN. You have just quoted from a document. Is that a statement that we have already put in the record? Or is it another statement?

Dr. HAAS. All except my allusion to Sir Isaac Newton was in the document that was inserted in the record, sir.

The CHAIRMAN. The question occurs to me: What, if any, evidence do we have as to the presence of poliomyelitis in early Indians or aborigines, either here or elsewhere? Do we know anything about that?

Dr. HAAS. I think that one of the other members of the panel might give a better answer than I.

The CHAIRMAN. None of us were around at that time. It would be a historical matter.

Dr. PAUL. At least it has been shown as a fact that the nearest approach to early Indians are the Eskimos far removed in Baffin Islands and away up in the Far North. All we can say is that polio has come seldom to them. There is good evidence from antibody studies that epidemics have come there few and far between, but when they do come they are very devastating. Children, parents, and grandparents have all acquired the disease simultaneously and great havoc has been wrought.

The CHAIRMAN. I wonder if environment has anything to do with it. At the present time we see polio strike in what we assume to be our best homes, from a sanitary standpoint, and it also occurs in the homes of the underprivileged, so one seems to balance the other so far as environment is concerned. I have in mind that the Indians did not have the fine medical attention that we think that our people have at the present time. They had their medicine men. They used their own remedies, their herbs, and so forth. They lived an outdoor life. I am just wondering whether we have really improved upon the early Indians, or whether we have made ourselves more susceptible to disease.

Dr. PAUL. In this country they did not have smallpox or measles, apparently, and the colonial settlers brought those rather unwelcome gifts.

The CHAIRMAN. If there is anything in Indian knowledge that contributed to the preventing of polio, maybe we had better go back to the Indians.

Dr. SABIN. It is possible that the Indians before the discovery of America 500 years ago had not been exposed to the virus at all. There are still even now isolated communities in the world in which it is quite possible that the virus has not been brought in. Only a few years ago in an island off the coast of India, where apparently the polio virus must have been brought in for the first time, there occurred an epidemic, the size of which in character, if it were to strike Washington on the same basis, would paralyze almost a quarter of our population in a short period of time. There are no records of the Indians, as there are of the Egyptians, which would indicate from their skeletons that they experienced poliomyelitis.

The CHAIRMAN. Do you mean that the mummies that have been discovered have given evidence of the presence of polio?

Dr. SABIN. Yes, and that is judged in the following way: If a child develops polio during the period when it is growing, and if it has it only in one leg, the unaffected leg will grow to its normal length but the paralyzed leg will become stunted and small, and there are deformities. Some things have been found in Egypt dating back thousands of years that make it highly probable that the cause of those deformities and that stunting in development was polio. That is one of the ways you can reach some tentative conclusion on archeological specimens.

Mr. HESELTON. What is a virus?

Dr. SABIN. A virus by current definition——

Mr. HESELTON. Is it different from a germ?

Dr. SABIN. It differs from a germ in its complexity, in its size, and in its ability to multiply in the absence of another living cell which it must parasitize. The ordinary germs, those of tuberculosis and pneumonia, and so forth, are so highly complex that they can perform their own functions of life. Give them a good enough broth and they can grow and multiply. No virus is capable of doing that. A virus must, first of all, be very small; secondly, it can multiply only in the presence of certain living cells which provide for it the mechanism of life which it, itself, does not possess. That is very crude, but roughly that is what it is.

Mr. WILLIAMS. I would like to ask a question of the representatives of the Public Health Service. I believe you mentioned a few minutes ago certain discoveries which have been made by scientists in the Public Health Service. You also mentioned Bethesda in connection with that. In what other Government laboratories do they do research work?

Dr. HAAS. We have laboratories at Montgomery, Ala., which are part of the Communicable Disease Center, the so-called virus laboratory. They work on polio and other virus diseases.

Mr. WILLIAMS. Are those Government laboratories?

Dr. HAAS. Those are Government laboratories. Work is going on there.

Mr. WILLIAMS. The thought occurred to me that we have several agricultural research laboratories engaged in research on new uses for agricultural products. Since they have been in existence they have done a wonderful work in promoting the interests of agriculture and of the agricultural economy in this country.

I know that other Federal agencies have laboratories to carry out similar research in other fields.

Now, the point of my question is this: Do we have anything similar to that in medicine in this country, a medical research center in this country?

Dr. HAAS. Yes.

Mr. WILLIAMS. Sponsored by the Federal Government?

Dr. HAAS. I think it is fair to say we do. We have the Government laboratories which we have mentioned. We have additional Government laboratories engaged in other fields of medical research. We have the Arctic Laboratory in Alaska and we have the Environmental Health Center at Cincinnati. Beyond that, we grant to nongovernmental laboratories many millions of dollars annually for medical research in a way that is quite similar to that which Dr. Van Riper has described for the foundation grants for polio research. I believe it is fair to say we have an extensive system of medical research in this country.

Mr. WILLIAMS. Do you think it is adequate to meet our present needs—the physical facilities that we have?

Dr. HAAS. Well, sir——

Mr. WILLIAMS. I mean for carrying on a first-class program of research in medicine.

Dr. HAAS. I believe that Dr. Price might give a better answer to that question than I.

Dr. PRICE. I think that is a very difficult question to answer, and the answer you get will depend upon whom you ask.

There has been a very great tendency, perhaps more in the field of medical science than in some others, to place the principal emphasis of research outside of official Government laboratories, so that the vast majority of medical research is performed by universities and medical schools and independent research units that are affiliated with hospitals and which have their support from nongovernmental sources. This is more the case in medical science than in some of these other fields that you mentioned.

There have been many attempts to evaluate the adequacy of those facilities, and almost invariably one gets the answer that they are inadequate if one considers them in relation to some theoretical ideal amount of research one might conceivably carry on.

However, in terms of the number of individuals who are now trained and ready to carry out research programs, I think one would have to admit that we are near to a balance, and that in order to utilize effectively very much more in the way of physical resources it would be necessary simultaneously to develop a great many more skilled individuals.

Perhaps some of the other members of the panel would like to comment on that.

Dr. SABIN. I would like to ask a specific question: Is the United States spending as much money on research on diseases affecting human beings as it is on diseases affecting animals?

Dr. PRICE. I cannot quote the figures, but I think we are not.

Dr. SABIN. That question is in line with your thinking, Mr. Williams.

Mr. WILLIAMS. Do we have any group engaged in coordinating or interchanging the information that is developed in these various labo-

ratories over the country, whether they are medical laboratories, agricultural laboratories, or whatever kind of laboratories they may be, in order to see that there is a full exchange of information? For instance, I understand that out at Beltsville, Md., one of my former schoolmates recently discovered a new drug made out of tomatoes. He was trying to discover new uses for the tomato and he discovered the drug. I suppose that you have ways of coordinating that type of work and information so that it can be made available to the medical field?

Dr. PRICE. Yes. There are several actively working scientists here at the table, and I would like very much to have one of them answer the question because they are more directly concerned with it than we administrators.

Dr. HAMMON. I would like to answer that, in part with something I was going to voluntarily supplement Dr. Haas's report with. As an outsider from the Public Health Service, I think a medium of the Public Health Service has been the published reports, the Public Health Reports. This publication has been an excellent source of dissemination of scientific knowledge, not only on research in the Public Health Service laboratories, but research done in the university laboratories. I think that needs emphasis here. Public Health Reports has served an excellent function in disseminating information regarding scientific research. The number of journals in this country where one can publish these reports—and unless they are published they are of no particular use to anyone else—is limited. The length of the articles is greatly limited—the amount of detail that you can put in. Public Health Reports is a medium of publication and an important one, and I would say that some very classic and some very important reports on polio have appeared in that journal.

Dr. SABIN. Scientific knowledge is disseminated by publication in accepted journals. You have touched, however, upon one of the greatest problems facing science at the present time, and that is, with the amount of scientific work that is being published, it is almost impossible for people, even in their own limited fields of investigation, to absorb and digest it all, and many new attempts are being made somehow or other to bring to the attention of those who need the information in digest form what is going on, so when he is interested he can go back to the original source.

Scientific publications still remain the chief means of scientific dissemination of knowledge.

Dr. HAAS. May I suggest also that we may emphasize here the importance of meetings of scientific and professional societies, and the fact that personal contacts, the opportunity to discuss one another's experiences and one another's ideas is a very important supplement to the opportunity to read published and republished material. In fact, many times in personal discussions a scientist is able to get ideas from another scientist that he would never get through the normal medium of publication.

Mr. WILLIAMS. I think maybe this is the question that I wanted to ask a minute ago: To what extent, if you are able to judge it, is the progress in research being retarded by a lack of physical laboratory facilities throughout the country, or to what extent could research be accelerated by making available more laboratory facilities throughout the country?

Dr. SABIN. I think that this ought to be answered by people on the floor, Dr. Price, Dr. Andrews, and Dr. Haas. It comes under item 10 of the agenda. This is as good a time as any.

Dr. PRICE. I am frank to admit that I do not know the answer. To me it is an exceedingly complex one in which I think one cannot isolate the three factors of physical facilities, trained personnel, and funds for maintenance. I think one would almost have to tie the three up together. It is easy to say for the good of society there needs to be a very great deal more medical research. It is like a lot of other things. If we had the resources available it would be nice to have more than what we have, but whether one can say that if we had more physical facilities we could make faster progress in the absence of additional trained manpower, I would question.

Mr. WILLIAMS. As I understand it, that is the end purpose of these hearings—to determine what, if anything, the Congress can do to accelerate this program of research in order to find the eventual answer to the problems posed by these very serious and difficult diseases that we have been hearing testimony about the last several weeks.

Do you feel it would be of great help for Congress to make available more and newer laboratory facilities; and if so, in what manner could we do it in order to speed up this program and possibly bring about the eventual end of polio, cancer, and these other diseases?

Dr. PRICE. With specific reference to polio, I would like to hear what Dr. Van Riper would say about the ability of the polio-research field to utilize additional facilities. He is much more familiar with that than I.

Dr. SABIN. It is on the agenda for later on. We are jumping around. If you are going to be here a little longer, that comes up later and we can take a look, so to speak, at the future of polio research. Then we might see whether or not everything that is needed is available.

With your permission, Mr. Chairman, we might perhaps stick to some of the other aspects of the role of the Public Health Service. I would like to ask Dr. Haas two questions:

One of them is, Is it a fact that one of the reasons the National Institutes of Health and other laboratories in the Public Health Service have not allocated as much of their funds and time to the investigation of poliomyelitis is due to the large amount of money that was expended in the universities and other institutions on this particular disease? That is question No. 1.

Question No. 2: Do you believe that through the Public Health Service, or somewhere within it, there may be a special role for developmental work? What I mean by that is this: If research in university laboratories has shown that a certain diagnostic test would be useful to public health or control, but the developmental work of it is somehow or another of a nature that it cannot be undertaken in a university laboratory, or even when vaccine comes to a point where it is quite all right in a laboratory sort of way——

Dr. HAAS. My answer to each question is "Yes."

Perhaps I can supply an answer in each instance. In deciding what projects we shall select for research in the National Institutes

of Health—and I am sure that this applies elsewhere—we consider a number of points, such as the public information, the public-health importance of the particular problem under consideration, the possibility of making progress in view of present knowledge and leads that might develop, and equally important, we consider whether or not the field is adequately covered elsewhere.

In respect to poliomyelitis, we have felt for many years that the National Foundation for Infantile Paralysis supports research on such a scale that it would not be wise for us to direct our resources away from other important fields which are not so well covered to this one which is.

In respect to the second question, which is concerned with the development of knowledge that is produced—and I would amplify your question a bit; the knowledge may be produced outside the Public Health Service or within the Public Health Service—but, in any respect, certainly we do have certain unique facilities and opportunities to develop such knowledge. We have in the past utilized those facilities in that very way.

The Communicable Disease Center is ideally situated to develop things to the point where they can be used and I am sure that they consider that to be one of their primary missions.

Mr. HESELTON. As I understand it, you say that 80 percent of the total funds available are being spent for research, and is that, in your opinion, at this time under all circumstances adequate?

Dr. SABIN. You are referring to a statement by Mr. Barrows, I believe, of the funds expended by the national foundation.

Mr. HESELTON. How much is spent on polio percentagewise of the funds available to you for research?

Dr. HAAS. We have submitted as an appendix to our statement, which has been inserted in the record, a tabulation which shows that for 1953 the National Microbiological Institute, with an appropriation of $3,386,000, has allocated $72,000 specifically for polio research; that the Communicable Disease Center, with an appropriation of $5,919,750, has allocated for polio research specifically about $232,000. Those figures are not all-inclusive because in respect to the National Institutes of Health, for example, they include only the project designated "Poliomyelitis." They do not include the projects within biologics control, which are concerned with adequate standardization and safety measures for the vaccines, and they do not include some of our projects in basic virology, which are not designated as "poliomyelitis projects."

Dr. SABIN. I think perhaps the remaining hour or so we have might be used to reach an estimate of what research will be needed in the forthcoming decade, or what the precise status is, what will be needed in the forthcoming decade, particularly, and then to see what the facilities are that will meet that need, particularly since there has arisen an impression in the minds of scientists, physicians, and laymen, based upon certain very optimistic reports in the press, that research in polio is practically at the end of the road, that the solutions have for the most part been found.

I have personally found, not only in this country, but at a recent international congress abroad, the feeling among many scientists

that—well, perhaps, it is not worth while to enter the field of poliomyelitis because the problems have been solved. For this reason, I think that I would ask the question in the following manner:

Will more or less money and manpower be needed for research on poliomyelitis in the next decade than in the preceding one?

We will start out by examining the question as to just how far along the road we are at present to solution of important problems that have been listed here today.

Now, perhaps it would be unfair to pick on anyone else to do it, but I hope Dr. Paul will forgive me if I ask him to give his impression first.

Dr. PAUL. That is not an easy question to answer. It requires a lot of prophecy. I would say without hesitation that we are not at the end of the road. I would visualize for the next decade or so an enormous amount of work in poliomyelitis will be needed, research work which deals with methods of spread and methods of control primarily, but also we heard today from Miss Switzer that even if polio were stopped tomorrow the problem in rehabilitation would be terrific. I do not know how many thousands of patients would be with us for 10, 15, or 20 years. That is another field, of course. I would say without hesitation that at least the existing institutions and the existing universities—and we think of the State health laboratories which have not as yet gone into polio work, but they probably will—and the institutions like the Rockefeller Institute not directly associated with the universities—all still have a tremendous challenge before them in the problems that polio offers. That is a very broad generalization.

Dr. SABIN. With your permission, I will thank Dr. Paul and make a few provocative statements because Dr. Paul shied away, usually with good reason, from stating just where we are now, so that you will appreciate why it is that he thinks there will be so much to be done in the next 10 years.

When this session began, the chairman, Mr. Wolverton, said to me aside, "Look, I have just read this in the paper the other day, that a large test on polio vaccine will be made. Is there anything to it?"

Well, let me just make some provocative statements and analyze the situations as to just where we stand with regard to the development of a material that will ultimately be useful in the prevention of the disease.

This vaccine about which you read, and about which a lot of work is being planned by the foundation, is now coming to the fore only because for the first time there has become available a source of larger amounts of virus than we have had before. The principle of making such a vaccine is not new. No new discoveries have been made to permit work along those lines. The methods of inactivating a virus, those are as old as the hills, and they have been used before, so actually this is the first attempt to take and apply previous information on a large source of material. The questions are still very quantitative because the issue is not: Can we produce immunity in an individual if we inoculate with a vaccine? That is not the question because even 10 years ago we could inoculate an animal with large enough amounts of inactivated nervous tissue to make him immune. The question rather is: Can it be done with small enough amounts and

with material that is safe enough to be able to make it available to all those who need it. That is a quantitative problem.

The source of tissue which would have to be used to make such a vaccine is still to be derived from monkeys. Human tissue for one reason or another has not yet been considered safe enough to be useful. There are no sources at the present time, although further research may provide such sources.

Furthermore, on the basis of information published only 3 months ago—and there may be additional developments since then—the work had not yet progressed to the point where it has been shown that children who had no immunity whatever, no antibodies whatever to the virus, could be immunized with practically useful small amounts of virus.

Now, it is quite possible, because of the advances made in the last few months, that that perhaps has been achieved, but I want to point out that it is only the beginning. That is the first thing. It may be necessary to carry out many studies on safety, many studies on reproducibility. I, for one, would strongly oppose large-scale tests on tens of thousands and hundreds of thousands of children based on the work of any one investigator, however eminent, however great he may be, until that work has been reproduced by at least another laboratory and shown to be reproducible, and shown that it can be gotten every time.

That does not refer to experimental studies on small numbers of special groups of children, but I think when we are to go out and make studies of tens of thousands or hundreds of thousands, we must have these additional things.

The state of our work is of such a character now that there is only in effect one laboratory engaging full time in the study of the killed virus vaccines in relation to poliomyelitis. Other laboratories are entering into it now, but it is entirely too premature to know what will happen.

Those of us who have had to make such vacancies before know many years elapse before finding enough material to work with and being able to make something that is practical.

Now let me say another thing. I am one of those people who believes that a killed virus vaccine used against a disease which is a part of the human heritage, which is always among us, which is not brought in by some animal or insect from the outside, may not be a good way to do this. It may turn out to be the only way, and we must get all the information on it that we can.

Recent work in several laboratories has shown that newer techniques have been able to rob the poliomyelitis virus of their virulence; to convert viruses which produce paralysis in almost all inoculated monkeys and chimpanzees to viruses that will not. But that is just the beginning.

We must learn a great many things. That is information of the same order and the same character as that which has been obtained on the virus of yellow fever, which has become one of the most useful vaccines for immunization; and also that is true of the virus of smallpox, and so forth.

So it is not at all improbable that within a year of two there may be agents for active immunization against poliomyelitis, certainly, which

would have to be infected in the same way as with the vaccine that is under consideration now.

The point I want to make is that only a beginning has been made. To give the impression that everything has been done that needs to be done prior to a large-scale test for merely proving its effectiveness is, I think, misleading. I personally think we are only just entering. The door has only just been opened.

All of these optimistic statements that Dr. Van Riper made this morning could not have been made 5 years ago. They could not have been made 3 years ago.

Let us differentiate between optimistic statements regarding hope for progress in the future and statements that mean achievement today. Yes, we can be optimistic for achievement in the future, but the achievement as of today is only beginning.

Even after those things are achieved, everybody in the public-health field knows that when you reach the point where you can begin to inoculate an agent into millions of children, your problems have only just begun. You have to begin to learn what it does and how to use it.

That has been the experience with many agents before. It has gone on for years.

I think that with these perhaps slightly controversial and challenging remarks I would like to hear from Dr. Van Riper and from anybody else on this panel expressions of ideas along this line which will permit us to project into the future the work that has to be done.

My remark is that, in my opinion, we have more work to do in the future than we ever had in the past because for the first time we have something to work with. And I say that the facilities available now are facilities which were good enough for the past and are not good enough for the future, and that the reason only 8 percent of the funds are being expended for research on poliomyelitis is because actually there were not the tools with which to work, and we did not have the trained personnel with which to carry on the work, and there were not the innumerable problems that had to be investigated.

Now we shall hear different ideas on this subject. Dr. Van Riper, would you please comment.

STATEMENT OF DR. HART E. VAN RIPER, MEDICAL DIRECTOR, NATIONAL FOUNDATION FOR INFANTILE PARALYSIS—Resumed

Dr. VAN RIPER. If I gave any impression in any of my statements this morning that I thought the problem of polio had been solved, let us get the record straight. I certainly never intended to give such an impression.

To further back that up, I might say that just last week grants that will become operative in January of 1954 were presented to our committees, and in total amount of funds it was one of the largest recommendations of allocations we have ever had. I am quite sure that if the national foundation felt that we had a vaccine that had answered all of the problems of polio we would not continue to support research not only in further studies of vaccines but even in chemical studies to determine whether or not we might find some chemical or biological agent which might be effective in controlling this disease.

Indeed, we have not put all of our eggs in one basket, and we have no intention of doing so.

As Dr. Paul will bear me out, he has had a recent and unhappy experience with the press when he chaired a committee of the World Health Organization in Rome, in which they made certain statements. I was accosted when those statements got out, in Chicago, and everybody thought I would be so excited. I said, "Until I see Dr. Paul and determine exactly what he said I shall reserve judgment."

Now because the press has said that a trial was going on does not necessarily make it so.

Again, I would like to get the record straight: The national foundation does not have a vaccine. One of its grantees had developed what he considers to be a trial and experimental vaccine. Until such time as it is proved to be effective, it is not the finished product.

As I also said to Dr. Sabin in discussions earlier this morning, one considers the control of the disease and thinks back not too many years ago, when diphtheria was a disease which was pretty widespread throughout this country. We first treated it with antitoxin, and then we gave toxin and antitoxin as a means of producing an active immunity by artificial stimulation. Today we have dropped the antitoxin and we are now to toxoids.

I think even if the vaccine that has been so widely publicized is capable of producing immunity in individuals and that if those individuals are therefore resistant to paralytic infection, I still think considerable amounts of money will continue to be spent in searching for a better vaccine.

I think Dr. Salk is important in this. It is unfortunate he is not here this afternoon, because I cannot and will not attempt to answer some of Dr. Sabin's questions, because I am not researching the vaccine. I am not a virologist and I would not attempt to fully answer Dr. Sabin's questions.

Dr. Salk might not be able to answer Dr. Sabin's questions to Dr. Sabin's satisfaction, but at least he would be able to make answers which I am not going to attempt.

I do not know what we are going to do so far as a field trial is concerned. I do not know how many people will be involved, where it will be, or what we will do.

First of all, those of us who have any interest at all in this today recognize and affirm what Dr. Sabin said: Dr. Salk's process of inactivating the virus is not new. We have already investigated to determine whether it is patentable. It is not.

May I hasten to say that we were not interested in patenting this to do anything more than protect the public from getting a vaccine that did not meet standards or that was going to cost more than it was worth, because the people of the United States, if we have produced anything, have paid for it already and they should not have to pay again.

If we can do no more than determine some questions which must be determined on something more of a widespread experimental basis than is presently available, that is what we hope to do.

The vaccine which has been produced today has been produced on the bench in the individual's laboratory. None of us know today whether it is possible to reproduce that work on a commercial basis.

Many an invention has been built by hand that could never be produced on the assembly line. We know that.

I regret some of the premature publicity that has been given to this. I am sure Dr. Salk is much more exercised about it than I am. Polio is not conquered. When it will be remains a question.

But in closing I would simply like to point out that with the incidence of polio having tripled in the last 5 years, a foundation supported by the public cannot sit quietly by and not use any development that has shown any promise. In other words, can we wait another 5 or 10 or 15 years if a laboratory is able to produce something that will protect you in only one epidemic season?

Thank you.

Mr. HESELTON. I feel certain that the chairman will agree with me, and I feel that my colleagues here will agree with me in saying that in view of the recentness of Dr. Salk's study on that vaccine and in view of the fact that he, in perfect propriety, has been drawn into this panel's discussion, the committee will probably want him to see the transcript and furnish any statement he cares to furnish in order to have a clear statement from everybody concerned.

Dr. SABIN. Mr. Chairman, Dr. Hammon, who works in the same university and building with Dr. Salk, raised his hand, indicating he would like to comment on this subject. May we hear from him now?

Mr. HESELTON. Certainly.

STATEMENT OF DR. W. McD. HAMMON, HEAD OF DEPARTMENT OF EPIDEMIOLOGY AND MICROBIOLOGY, UNIVERSITY OF PITTSBURGH, PITTSBURGH, PA.—Resumed

Dr. HAMMON. I do not want to disappoint you in the fact that Dr. Salk and I am in the same university. I am not going to say anything about Dr. Salk's vaccine. I do not know anything about his work except what was published. He is in the medical school and I am in the school of public health. I have no more knowledge about his work than the others here. I think the others have more knowledge than I have, because they have met with him in other committees and I have not.

What I want to say, before I have to leave very shortly, is to say that with regard to the statements made by Dr. Sabin a moment ago I am 100 percent in concurrence. I believe we are really getting started in the field of research and control of poliomyelitis.

As an example I would like to remind you that we are still doing research work in smallpox despite the fact that Jenner had a vaccine available many years ago. There are still many who are actively engaged in the study of diphtheria, despite the fact that we have gone through the days of toxin, antitoxin, unprecipitated toxoids, precipitated toxoids, mixed toxoids and other vaccines, and so on.

And there are some great research studies going on now. Actually, the problems have changed in diphtheria. We were far too optimistic, perhaps, about diphtheria, when a suitable means of immunization came along with an inactivated material. Now we have a new problem.

We have stopped the dissemination of virulent diphtheria bacilli through immunization of many children, and now many adults are getting to an age where the means of immunization we have are not satisfactory for use in adults because of severe reaction, but the adults

must be immunized because they are no longer being immunized by a natural process, which used to be the occurrence of the disease.

It was a matter of fact that persons over 15 or 20 years of age did not need diphtheria immunization, but having immunized almost all of the children so as to cut off the dissemination of the diphtheria bacteria, we now have a sizable proportion of our adult population which is no longer immune to diphtheria. This is a problem for our armed services. They are trying to find some safe method of immunizing personnel against diphtheria. Methods have been difficult to develop, or unsatisfactory, and diphtheria is still a real problem with us.

To come back to the possible parallel in poliomyelitis, I would like to point out that it is a fairly common concept today that if a person is immune to poliomyelitis, having had the infection or probably having been vaccinated, that he will not get reinfected or shed virus so that other people will become infected from him. I do not know that to be a fact. Many people believe that.

There are others who believe, on rather reasonable evidence, that a person who has already had poliomyelitis and is immune because of that infection, whether he had a clinical disease or not, can be reinfected and can serve as a carrier of the virus to others.

That is a problem to which we do not have an answer. We are trying to find an answer, but we do not know.

Let us consider the two possibilities. If the artificially immunized child is unable to become infected, the virus does not multiply in his body and he does not excrete it from either the throat or the feces. Then we immunize practically all of our children with dead virus, and that immunization is given to them at the required interval, whether it be 1 year, 3 years, 5 years, or whatever we find is necessary to continue his immunity. When he gets to be an adult, will we have to continue that immunization at that same interval so as to have an adult population which is immune?

At the present time our adult population is rather highly immune. We do not have very many cases of poliomyelitis among our adults. The proportion with the paralytic disease is much lower than it is in children.

But we may create a problem where we have a larger number of adults susceptible because of artificial immunization, with a cut down in the spread of the virus and natural methods of immunization no longer being operative, as they are operative at the present time.

So problems are going to be created. Whether that will be one of them I do not know. It may be one of them. It is an answer we have to get in epidemiological studies.

One of the purposes of our current studies in the Philippines is to try to find out: Can an immune person be reinfected and carry the virus?

Problem after problem will arise. There will be new problems. There will be new methods of immunization. There will be changes, and so forth, before we have any final answer.

I again give my two-bits worth, that we have many years of very fruitful study ahead of us in poliomyelitis research.

Mr. HESELTON. Dr. Paul, before we go too far, reference was made to a statement you made, I believe, while you were attending a meeting in Rome. I do not know whether your attention has been called

to the fact that that was brought up at the first poliomyelitis hearing, and the press release was read in connection with the discussion. If you care to say anything for the record I want you to be perfectly free to do so now.

STATEMENT OF DR. JOHN R. PAUL, YALE UNIVERSITY SCHOOL OF MEDICINE, NEW HAVEN, CONN.—Resumed

Dr. PAUL. Well, I saw the newspaper reports after I got back to this country, and I must say I was very much surprised with them, because they are about as far removed from anything I thought went on at the meeting as could be.

Two statements were brought to my attention in the release. I am not privileged to talk about the actual context of our report, because that is not going to be released until next spring, but two statements were brought to my attention.

One of them was that in the actual release dated September 22, that went out from the United Nations. The statement in the release was:

> The committee condemns widespread and indiscriminate administration of gamma globulin.

Now we are talking about another form. Well, somebody, in order to save space or words, crossed out the words "widespread and indiscriminate" so that it came out in the report that the Committee condemned the administration of gamma globulin, which was a little of what you might say an overstatement.

Another point was that this meeting was concerned with the control of poliomyelitis in the world, not necessarily in the United States. We are the only country which has large supplies of gamma globulin, I believe, which are available for use on what might be called a mass administration basis.

Gamma globulin is available in Canada, in England, and in Scandinavia in smaller amounts, and is parceled out with a good deal of care there for use in special situations.

The statement made there was:

> It is unlikely that gamma globulin can be used for mass inoculations against poliomyelitis epidemics.

In other words, our comment had back of it the idea that this was not a necessary substance to have in order to stop epidemics. I think most people will agree, in this room, who have studied the point, that that is not what it is felt this product can do. This was somewhat distorted, but the feeling was that the Committee was distinctly against the use of this substance.

I do not know whether that clarifies it.

Mr. HESELTON. I think it certainly does.

I might add that there was some discussion of two mass inoculations in two of the countries, and of the incident that occurred in New York City in Mr. Klein's district. Our colleague was at the hearing at the time, so he could tell us quite fully about it.

A question arose, because the gamma globulin is apparently controlled by the infantile paralysis fund, about the use of it. At least somebody had contracts for the full supply, and the question was whether the mass inoculation was better or not. I realize there would have to be some demonstration of the incidence of the disease, but it

was a question of whether the use of it on a geographical basis was better than on a selective basis.

I do not know whether you care to comment on that or not, in view of what you have just read to us.

Dr. PAUL. I am sure there are others in this room who have been familiar with this very much to the fore problem as to the pros and cons of the administration of gamma globulin. Certainly both have their use in this country.

The only point I wanted to make about this report was that it was not felt by the committee that met that you could stop epidemics, and many countries did not appreciate that was true.

We have used gamma globulin in measles here for years, but there is no concept that we could ever stop an epidemic of measles by its administration.

Mr. THORNBERRY. May I ask a question right there?

Mr. HESELTON. Yes.

Mr. THORNBERRY. As I understand it, the use of gamma globulin has been pretty much the same as the use in the case of measles. That is, you have a child who has come in contact with someone who has measles, and the gamma globulin is used to try to offset that contact, to keep him from being infected with measles. Is that how gamma globulin is used for polio, also?

Dr. PAUL. If I have understood you correctly, I think that is correct, sir.

Mr. THORNBERRY. I want to be sure I am understood. The use of gamma globulin in polio is like it has been in measles. For instance, a child comes in contact with another child who has had measles, and the gamma globulin is used on the child to prevent him from getting measles; is that the thought?

Dr. PAUL. Yes. The chances are better in measles. I think this question should be turned over to Dr. Hammon. The chances are much better in measles because the incubation period is longer.

Mr. THORNBERRY. All right.

Dr. SABIN. Since Dr. Hammon is about to leave perhaps he would have a statement on this question before he leaves, if that is in order, Mr. Chairman.

Mr. HESELTON. Certainly.

STATEMENT OF DR. W. McD. HAMMON, HEAD OF DEPARTMENT OF EPIDEMIOLOGY AND MICROBIOLOGY, UNIVERSITY OF PITTSBURGH, PITTSBURGH, PA.—Resumed

Dr. HAMMON. The use of gamma globulin for poliomyelitis is certainly far more complicated than the use for measles, and the limitations are much greater.

I wish I could have been here for the first conference in which this was discussed more fully. I know there have been many criticisms regarding the publicity given to gamma globulin. Great hopes were reached and then suddenly the facts became apparent, that there were so many limitations to its practical use that it was not the answer to the question.

I would like to put into the record, while I am here, the fact that these limitations to its practical use were fully appreciated by those of us who did the work, and we wrote a description of those limita-

tions in our original paper. We pointed out the fact that it was not an ideal agent, that it had very limited practical use, because poliomyelitis behaves so differently from measles.

With measles, every mother knows whether or not her child has had the measles. That is 95 percent correct, at least, because the disease can be readily diagnosed. Very frequently you know when a child is exposed to measles, and by whom, and on what day; and that almost never occurs in poliomyelitis. Most infections with poliomyelitis are not diagnosed. The mother does not know whether her child is immune or susceptible to poliomyelitis.

Furthermore, in measles, when exposure of a susceptible child occurs, that child is almost certain to get the clinical disease. In poliomyelitis, even though he becomes infected, the chances are he will not have the disease that can be diagnosed as poliomyelitis. It will either be a very mild, harmless type of infection that cannot be diagnosed; or a slightly more severe case which is nonparalytic; or, in rare instances, the paralytic form, which is recognized. Therefore, we cannot predict which child would need immunization when the immunizing agent is available only in limited quantities. We do not know when he is exposed. We do not know to whom he is exposed. We do not know what would be the results of exposure even if he were not given gamma globulin. Most of them would get along all right without gamma globulin.

So it becomes a very complicated and involved problem to find out to whom gamma globulin should be given.

We do have an epidemiological study which indicates that within a family, when one case has been diagnosed, the incidence in the other members of the family is usually higher than it is in the community in general. In measles, all of the susceptible children would come down with it in the family. In poliomyelitis, one or two other children out of the immediate family might come down with it. But the risk is actually larger within the family than elsewhere.

Unfortunately, however, so many of them develop the disease within a few days after the first case that it is too late to give gamma globulin. Therefore, even by that method of application there are very limited results to be obtained.

The other means is in a community recognized as having a severe epidemic, with the giving of gamma globulin to all children in the most susceptible age group, and hoping that you will prevent some cases. Here, again, these include all the children who will be given the agent and who did not really need it. They would have gotten along all right without it. Therefore, its practical application is extremely limited and very complicated.

Dr. SABIN. Do you have any questions about the future outlook of the need for research in poliomyelitis, members of the panel, on the basis of the opinions expressed?

Mr. THORNBERRY. I would like to ask a question.

Dr. SABIN. All right.

Mr. THORNBERRY. There is a question which has been raised several times today, which may have been answered, but I have not caught it. Why is it that so many may become infected and yet there will be one person who will become paralyzed and another person who will not? In some cases it is not a diagnosable case, or is a very slight case. Is there a field yet in research to answer that question?

Dr. SABIN. Mr. Thornberry, the easiest way to get this point across is to say that that is something still to be discovered, although there are fragmentary bits of information.

Mr. HESELTON. Will you pardon the interruption, please?

Dr. Hammon, the committee wants to thank you for coming here. We certainly appreciate your attendance at this hearing and the fine presentation you have made.

Dr. HAMMON. Thank you very much, sir.

Mr. HESELTON. You may proceed, Doctor.

Dr. SABIN. There are fragmentary bits of information which would permit us to build up hypotheses. Those hypotheses deal with the role of the dose and the role of the virulence of the virus.

For example, experiments have been made in which it has been shown that if monkeys are fed repeatedly minute amounts of a very virulent virus, a very large proportion of them become infected and do not get paralyzed; but if you give them the same dose all at once, or in a day or two, a very high proportion become paralyzed.

There are also other possibilities now that people have worked with many different strains of virus. Some strains of virus will produce paralysis in a high incidence. In others it is a low incidence.

That is not the whole answer. There are also suggestions as to the genetic constitution, what a person is born with, that determines how he will respond. Experimental work has been done with other viruses to show that the constitutional environment of the animal determines how he will react.

Studies of different families in different parts of the United States show that there is a tendency for paralytic polio to run in the family in a way that makes it highly suggestive that the susceptibility to paralysis may be in part inherited if they are exposed to the proper virus.

But the final answer is yet to come. I think with that everybody would agree.

Dr. PAUL. At least we cannot pick out individuals who are going to become paralyzed and those who are not.

Mr. THORNBERRY. That is the reason, I guess, for the big problem. Thank you.

Dr. SABIN. It is unfortunate that Dr. Wise, who has been sitting here all of this time, has not had an opportunity to testify on the very important problem of what is being done and what needs to be done with the patient who is already paralyzed, because there are now tens of thousands of them in the country. We have 10,000 or 20,000 additional ones added each year, and they are going to be with us for a long time.

I wonder if Dr. Wise would speak on that now.

STATEMENT OF DR. CHARLES WISE, PROFESSOR OF PHYSICAL MEDICINE AND REHABILITATION, GEORGE WASHINGTON UNIVERSITY COLLEGE OF MEDICINE, WASHINGTON, D. C.

Dr. WISE. Thank you very much. To the individual patient who has poliomyelitis today or to the member of a family of a patient paralyzed with poliomyelitis, despite the exciting news of prevention in the future, the actual treatment and rehabilitation of that patient is still the No. 1 problem.

Despite the perhaps lack of glamour for the future in the rehabilitation of poliomyelitis victims when the day comes that we can prevent the disease, there is still a large backlog, as previous evidence has shown, of various degrees of crippling and disability among the poliomyelitis patients of the past. We can expect, from what I have heard today, a continuing burden of paralyzed patients in the future.

What can be done in the way of treatment for these patients? Perhaps I might just in a very brief and limited way outline what in general is being done for the paralyzed poliomyelitis patient today. After the patient's acute illness is over, when the need for a life-saving measure such as the respirator and other acute medical emergencies has passed, the problem then becomes one of rehabilitation. Many advances have been made in the past two decades in the management of the paralyzed poliomyelitis patient.

These are just a few medical points. First, we can now perhaps limit deformities even in the more severely paralyzed patient to a greater degree than we ever could in the past. We do not see the severe deformities nearly as frequently today as we did in the past. That is perhaps related in large part to improved techniques; nursing care, physical therapy, early orthopedic attention, prevention of contracted muscles and contractures about the joints, deformities of the spine, et cetera. These improvements in technique and physical therapy, physical medicine, nursing care, can largely be attributed to the stimulation of the National Foundation for Infantile Paralysis in spreading throughout the country knowledge of proper methods and techniques on early care of the paralyzed patient.

After the acute stage has passed, the early convalescent stage begins and we next have the problem of rebuilding whatever residual muscle power is left in the patient. It has already ben pointed out that once the nerve cell is gone there is nothing we know of today or that can be hoped for in the future to replace that particular muscle nerve fiber. There are, however, many residual fibers and partially paralyzed ones which, by the use of techniques which have been developed and improved on in the last decade or two, can develop maximum strength and function in the remaining muscle power that is available.

After a program of developing these muscles to a maximum has been carried out, we then turn to orthopedic surgery in certain individual cases, where advances in orthopedic surgical techniques have enabled us to transplant certain strong muscles to supplement the work of the weaker muscles for a given purpose.

Advances have also been made in orthopedic surgery in limiting the deformities due to unequal bone growth, as was mentioned previously with regard to the paralyzed patients.

There have been other areas of advance, particularly in much more functionally improved bracing, and mechanical devices of all types which enable the paralyzed patient to become more independent and self-sufficient.

I can only mention in passing the tremendous work that has been done in advancing our knowledge of the paralyzed respirator patient and rehabilitation of those patients and keeping them alive, where previously the life expectancy was much lower than it is today.

Grouping all of these medical advances and many, many others which I cannot even touch on today, one might say we are entering a

new field in the management of paralyzed patients, which we call rehabilitation.

Just for a brief definition, we consider rehabilitation as the preparation of the patient physically, mentally, socially, and vocationally for the fullest possible life compatible with his ability and disabilities.

Miss Switzer has already commented on the important work that the Office of Vocational Rehabilitation is doing in this field. Let me touch briefly on the medical problems involved in rehabilitation.

First of all, the work done in poliomyelitis is such that I would like to point out that rehabilitation of the poliomyelitis patient has had far-reaching effects in the rehabilitation of many suffering from other chronic diseases and other forms of physical disability.

To point out just a few facets of their program, first there is the training of physical therapists. There are at present approximately 6,000 or less physical therapists in this country. Two thousand of these have been trained by the national foundation. A rather recent survey of the needs of this country in the total field of rehabilitation over and beyond that for poliomyelitis alone, has shown that we could use certainly twice as many or three times as many physical therapists today, and an increasing number in the future.

There is also the training of physicians in the field of rehabilitation. There are at present something around 200 trained specialists certified by the American Medical Association's certifying board as specialists in the field of physical rehabilitation. This is a minimum number and we need many more physicians specializing in this particular field.

Third, the facilities for treatment in this country today. I would like to point out that the facilities for managing the severely disabled poliomyelitis patient do not differ to any great degree from the facilities that are required in the rehabilitaion of many patients affected by the other chronic disabling diseases.

There is a need for rehabilitation facilities, both connected with general hospitals and the so-called rehabilitation centers, where the severely disabled, including the poliomyelitis patients, can be taken care of. That is an everpresent requirement, and considerable interest should be devoted toward that end in the future.

I believe I can close by pointing out that the field of rehabilitation, which is more than just a medical problem and involves community vocational guidance, ancillary medical personnel and medical specialists, is, paradoxically, increasing and will continue to increase as medical science develops new techniques for saving lives and prolonging life.

Each year, as Miss Switzer pointed out, we are getting a total backlog of 250,000 new disabled patients. As the life expectancy increases, as degenerative diseases and associated disabilities increase, as there are improvements in surgery, and as defenses against infectious diseases are found, all of these things will save lives but yet put a greater burden on medical science and the community for rehabilitation purposes.

I think that the work of rehabilitation which was so largely stimulated by the national foundation will become an even greater challenge in the next few decades.

Mr. HESELTON. Any questions, gentlemen?

Doctor, this question certainly should not be addressed to you or to your testimony alone. It might be addressed to the full panel,

and I rather think it could be addressed to most of the witnesses who have testified. This is as to the shortage of personnel, whether it be physicians or nurses or therapists or any others. This committee struggled with that problem without too much success a year or so back. One of the questions which arose, which seemed to be a hurdle that nobody could get around, was the sheer fact that if you trained these additional personnel you would have had absolutely no guaranty of getting them to practice where they might be needed. There were certain areas of the country where you had adequate medical care and medical personnel. In other areas, obviously, you did not. Then you come up with the $64 question. Suppose you get all of these additional personnel. Is that necessarily going to solve your problem?

Dr. WISE. Certainly one cannot expect all the personnel that is needed in almost any field of professional endeavor, but I think with increasing physical facilities for the aftercare of the poliomyelitis patient, as well as other severely disabled patients, everything that is possible should be done to recruit and train more skilled workers at every level.

A recent survey showed that it is not, for example, the lack of suitable training facilities for the physical therapist which is a problem. The available schools are not filled. It is the competition for professional workers in all areas which results in the present shortage of nurses, physical therapists, occupational therapists, and so forth. I think it is largely, at the present time, a recruitment problem at that level.

On the recruitment of physicians, I might mention that through the Office of the Surgeon General, Public Health Service, there has been established in the past year and a half grants-in-aid for training of physicians both in the specialty of physical medicine and rehabilitation, and in rehabilitation as it applies to other related specialties. I think that program has done a very significant service in attracting suitable caliber personnel on a postgraduate level to the medical profession to devote their time and energy to this field.

Your question as to whether we can assure a proper relocation and distribution of trained people is, of course, an ever-present problem, and I do not think we have any answer to that.

Dr. SABIN. Is there anyone else on this panel who would like to comment on the question of the problem of aftercare and rehabilitation of the paralyzed patient?

If there are no other comments on this, I think we might go to the last item on the agenda, which reads: What needs to be done that is not now being done to make steady progress on a national and local basis against this disease. I would like to ask Dr. Andrews to open this discussion.

Dr. ANDREWS. Actually, Mr. Thornberry mentioned the very question I had in mind and you discussed it, so it became unnecessary for me to pursue the matter any further. It is hard to speak specifically of what needs to be done now to make steady progress on this problem. One can say, in general, that the more facilities one has which are commensurate with the people who are able to make best utilization of them the faster the job will be done. Speaking for our own installations, I am sure there are many places where improvements

in utilization and facilities could be made, but I do not know that I have anything more specific to recommend.

I think that much of the research that is going on now will multiply itself and will have to keep going. The research on the vaccine will keep going. I remember the evolution of our pneumonia therapy. When I was a youngster and had pneumonia, somebody plastered hot antiphlogistine on my chest and I thought I was going to die, it was so hot, but I did not, and it was not until in the thirties that there was a much better way of treating pneumonia by giving specific serum, and it was only a few years after that that the sulfa drugs made their appearance, and that was much better than the serum method was, and now we have penicillin. Who is to say when we should have stopped the research on treatment of pneumonia? Do we now know we have the best method for the treatment of pneumonia?

I think all the facilities that can be obtained, both within the Government and the voluntary foundations, should be brought to bear on discovering new and improved techniques for the prevention and cure of this disease, and to me there is a trilogy of them, three of them. One is the development of a biological preventive vaccine. The second is the development of a specific chemotherapeutic agent that would prevent the crippling aftereffects. That may evolve more by accident than by design. More and more, we see in the development of new drugs that things made for a specific purpose actually turn out to work better with another disease. I do not believe there are any antibiotics not tried on poliomyelitis now.

Third, now that we know poliomyelitis circulates in the blood, why is it that sometimes it gets into the central nervous system and has its destructive effect on the central nervous system? Perhaps it is a controllable thing.

None of these things are very specific but they point up my own conviction that we need to bring to bear all the facilities we can to improve our knowledge about this disease.

Dr. SABIN. I would like to express for the record that no one knows at the present time that the virus that is in the blood gets into the nervous system. There is no proof of that whatever. But that does not negate the importance of finding out why the nervous system is sometimes involved to the point of paralysis and sometimes not. But the point of the item of the agenda now under discussion is, What would you recommend being done, beyond what the national foundation and Public Health Service are doing now, in order to make steady progress, not to impede progress? Would you recommend specifically anything?

Dr. ANDREWS. I do not think I would, above what is now going on in the maintenance of those facilities at their present working level.

Dr. SABIN. Thank you. Dr. Paul, I wonder if you would comment on this question? Let us stick to the question. What needs to be done that is not now being done to make steady progress?

Dr. PAUL. I think it was Mr. Williams who asked specifically earlier in the afternoon, Should there be new laboratories built? I feel that one of the most important things in research against poliomyelitis and all other diseases is the type of individual who can be found and trusted and who shows by experience that he can achieve some-

thing, so that the man comes almost first. If there are such people I think they should be given the tools to work with and the place to work, and that comes first.

The building of laboratories as an adjunct; that is, what we call the supplying of facilities, I think should proceed cautiously. I believe there is a real danger in trying to push this thing too fast. This is a difficult and dangerous field and there are tremendous pressures to do something about poliomyelitis which we must all recognize and perhaps deal with as we see fit. I think the situation as it now exists is a fairly adequate one. I do not think there are any glaring omissions here and there. I think there is going to be growth, naturally. I think the State laboratories throughout the country may eventually answer Mr. Williams' question. They are beginning to go into the poliomyelitis field. There is an enormous opportunity for them to take this up, if and when the proper personnel comes in.

I have no specific things, Dr. Sabin, which I think must be done right now, and I should like to say as a parting word that we should proceed cautiously and not rush too fast in this field.

Dr. SABIN. I should like to ask, if I understood you correctly in the first part of your statement, about finding the man before you get the building. You have in mind the recruiting of people to work on poliomyelitis who are not now engaged in work on poliomyelitis? Can your remarks be so interpreted or not?

Dr. PAUL. I believe so. I think the fellowship programs which now exist, as I see them, in which a young man who is attracted to this field has an opportunity to put a year or 2 years in the field at a salary that will pay him a living wage, which was not available before, are a very, very important feature. The question of whether such a man will go on or whether there will be opportunity for him to work if he wants to go on, is something to consider if the man is of the right type.

Dr. SABIN. You speak of young men. Would you get men scientifically mature?

Dr. PAUL. I think that is just a chance.

Dr. SABIN. I would like to ask Dr. Haas to express himself on what needs to be done that is not now being done to make steady progress.

Dr. HAAS. Dr. Sabin and Mr. Chairman, I believe what needs to be done is to find the answers to the questions that have been asked today. I wish I could recapitulate those questions for emphasis. They are extremely important. But Dr. Sabin has from time to time pointed them up and has done it better than I could this late in the afternoon.

It is my feeling that what Dr. Paul said about finding the man and supporting him is one of the most important things in science, and I must say I speak only from the standpoint of research because that has been my whole career. I feel that if I could have things the way I would like them personally, I would provide every competent scientist with the maximum resources that he could adequately and wisely use. We are far from providing that today, and maybe we cannot afford to provide it—I do not know. But I would like to take every good scientific researcher and give him what he needs as long as he is able to use it adequately and well. I do not mean to restrict it to poliomyelitis or to any other field, because it is just as tragic to be wracked with cancer or some other disease as it is with poliomyelitis.

The answers come to the scientist following the leads he gets from the laboratory or from some flash no one can predict.

Perhaps what I have said is somewhat vague. It is difficult for me to be more specific. I think we should, to our maximum ability, support the good people as long as they merit support.

In respect to poliomyelitis, which, of course, is our subject today, I believe one specific thing I might say is I hope we will all go on as a Nation supporting the NFIP, which I think has contributed very greatly to our advances in this field. As an American I am happy and proud that private contributions in this country have permitted us to go as far along in this field as we have with funds provided by NFIP.

Dr. Paul has mentioned that more people are becoming interested in poliomyelitis. That occurs in every field where progress is being made. When progress is being made, there is a break, momentum increases, progress builds up, and more and more people get into the field. I am happy to say that that is what seems to be happening in poliomyelitis. Certainly we should encourage it to the maximum extent that our scientists are willing to enter the field and are capable of carrying on the work.

Dr. SABIN. Dr. Price, would you like to add anything to the subject? Let us remember we have covered much of this today. We should like either no recommendation or specific recommendations as to what needs to be done that is not already being done, particularly by the national foundation and the United States Public Health Service, on a national and local basis.

Dr. PRICE. I think I have nothing to add at this point, Dr. Sabin.

Dr. SABIN. Dr. Van Riper?

Dr. VAN RIPER. No, thank you.

Mr. WILLIAMS. May I ask one more question on the availability of laboratory facilities for research? Take the case of a doctor, perhaps a country practitioner, who may develop a theory for the possible cure of one of these diseases, but has neither the money nor the facilities to develop that theory. Is there any way now he can get help in developing that theory?

Dr. SABIN. I am sure many people here could answer that.

He would go either to a university or hospital or institution in which the particular work he would like to do could best be carried on. He would either get a job there or apply for a fellowship or ask for a grant to carry on that work, and unless his theory is so cockeyed no one would listen to him, I think he would have a darn good chance.

Mr. WILLIAMS. We have a group of young doctors in Mississippi under contract to the State to practice in communities of less than 5,000 for a period of 5 years. That is in return for a loan made to them for schooling. In the case of such a young man, who might have a theory about curing one of these diseases, would he have to wait that 5 years before he would be free to become associated with one of these groups?

Dr. SABIN. That depends on the State of Mississippi. If the State of Mississippi would find it to the best interests of all concerned to release him from his responsibility, he would not have to wait. Otherwise, he has a legal responsibility.

I wonder, Mr. Chairman, if I may make some remarks on this general subject.

I would like to begin by saying that research on the control and prevention or conquest of a specific disease is a little bit different from scientific research in general. It has a great deal in common with the process of development which occurs in industry where the product of scientific research in general, the knowledge so gained, is used to achieve a specific objective. In other words, you may have all the scientific progress made in a field in general, but to bring all that progress or knowledge to bear to achieve a specific objective requires a different type of organization.

I think this has a specific bearing on poliomyelitis. I think the utilization of accumulating knowledge on poliomyelitis is a special problem which cannot be left to the whim and fancy of an individual engaged in scientific research. As a matter of fact, I think in general the higher the caliber of the imagination and initiative of the individual, the less he is inclined to put those last, finishing touches on that will transform knowledge not yet applicable to that which is applicable.

Now, what do I think needs to be done that is not now being done to make steady progress on a national and local basis against this disease? For one thing, I believe that the amount of money that is being expended on research for the control and prevention of poliomyelitis is painfully small in comparison to that being collected. I am fully aware that the reason it is so small is not because money is being denied to people who may ask for it, but that it is small because there are not now enough investigators and institutions making such requests. For that reason, I believe a certain amount of direction for research in poliomyelitis is needed, and information accumulated, particularly in the last 3 years, makes it a particularly burning issue at this time. I would think one of the ways to achieve this particular objective is to go out and recruit people to do certain work, set up the general objectives without telling them precisely what to do, and getting them to do the work and acquiring the facilities for achieving that.

The national foundation has had a try at it, but that is where I think the Public Health Service can come in. Just as in the Department of Agriculture there are laboratories that engage scientific workers charged with the specific problem of acquiring scientific knowledge to achieve an objective, so I think there is room in the Public Health Service or some other part of the Government to carry out that particular function.

To conclude, I would suggest that the national foundation find means of utilizing a larger portion of its funds to achieve the necessary objectives so that there would not be one laboratory working on a vaccine, but possibly 2 or 3; so that there would not be a single laboratory or no laboratory engaged in finding a simple test to find out who is immune and who is not immune, but that there would be many. Those are isolated exemples. That requires recruiting activities that I think pepole in industry know better than we do, and perhaps we could call on them to help us out. I am wondering whether any future activity on the part of the Public Health Service might not bring greater service to the people along those particular lines.

Mr. HESELTON. Does that complete your testimony, Doctor?

Dr. SABIN. Yes.

Mr. HESELTON. On behalf of the committee I wish to express my appreciation to each of you for the fine way you have presented your testimony. We hope something useful will come from these hearings. We know there has been some inconvenience to you in coming here to present this testimony, and we want you to know that we appreciate it and hope what the committee can do will be of some tangible benefit to you.

The committee stands adjourned until 10 o'clock tomorrow.

(Thereupon, at 4:40 p. m., an adjournment was taken.)

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